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2018 NEWEA Annual Conference

Tertiary Filtration Process Performance Testing to Meet 0.05 mg/l Total Phosphorus

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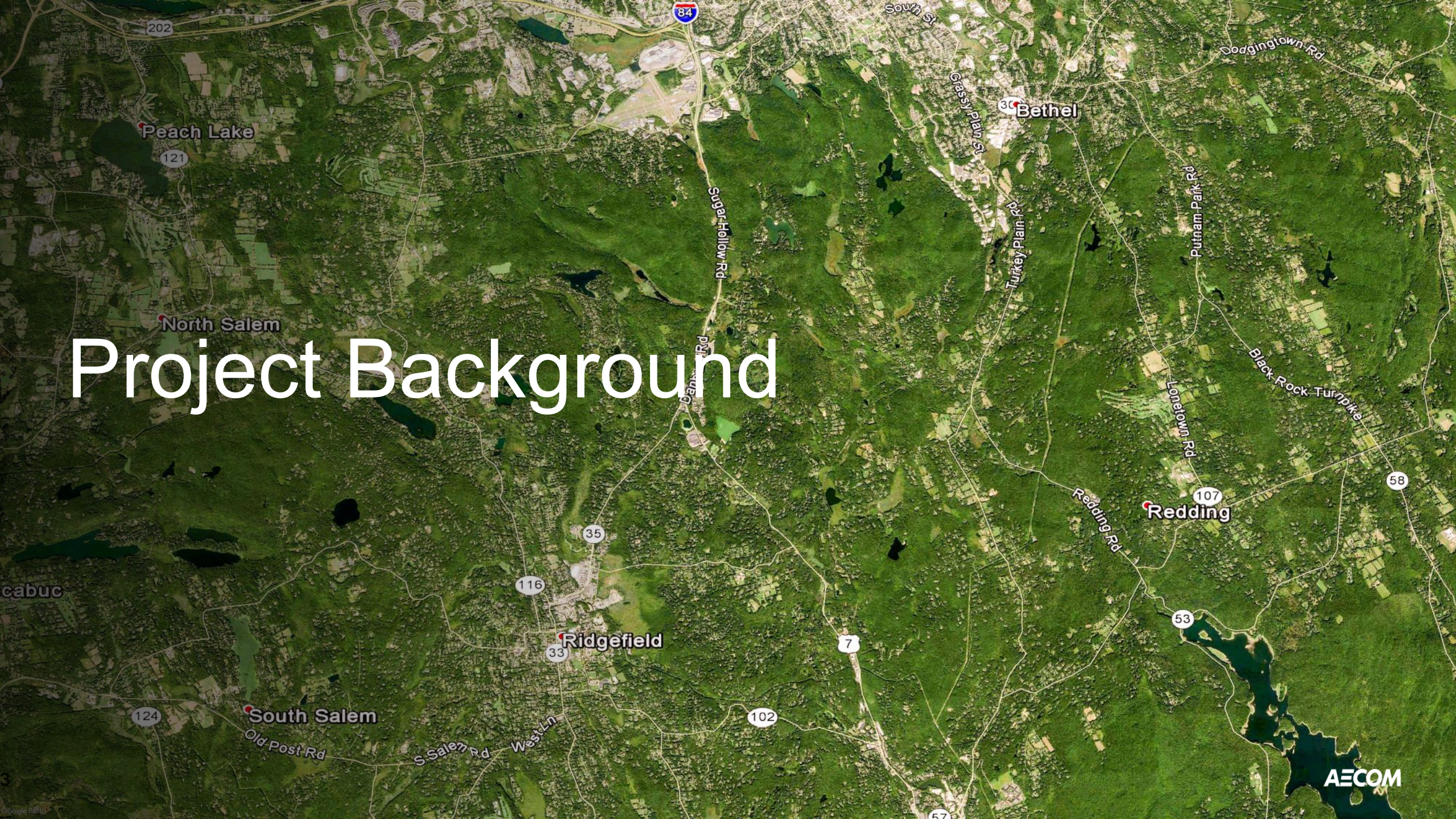
Agenda

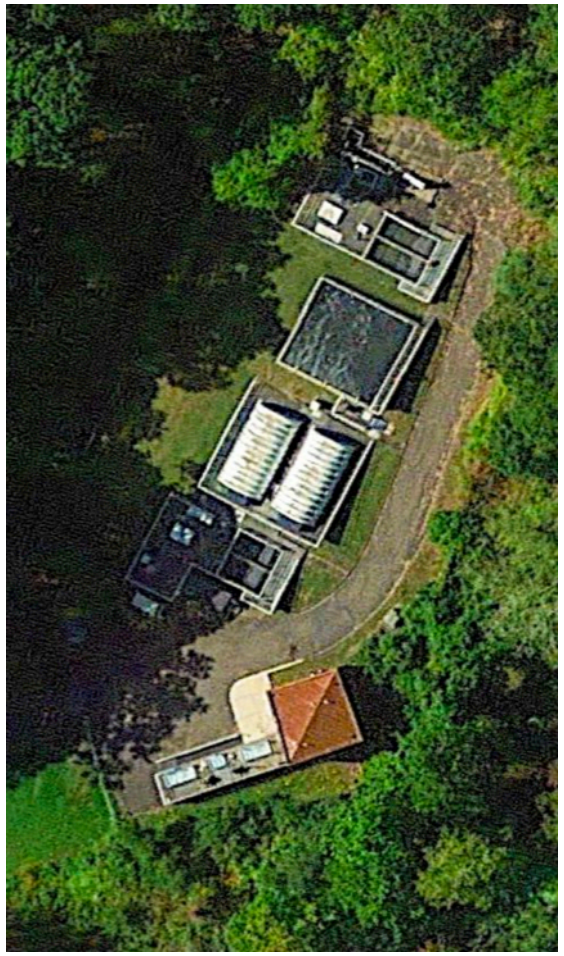
- Project Background
- Initial Technology Selection
- Performance Testing Approach
- Performance Testing Results
- Lessons Learned
- Next Steps
- Conclusions



Project Background

Project Background

South Street WWTF



Route 7 WWTF

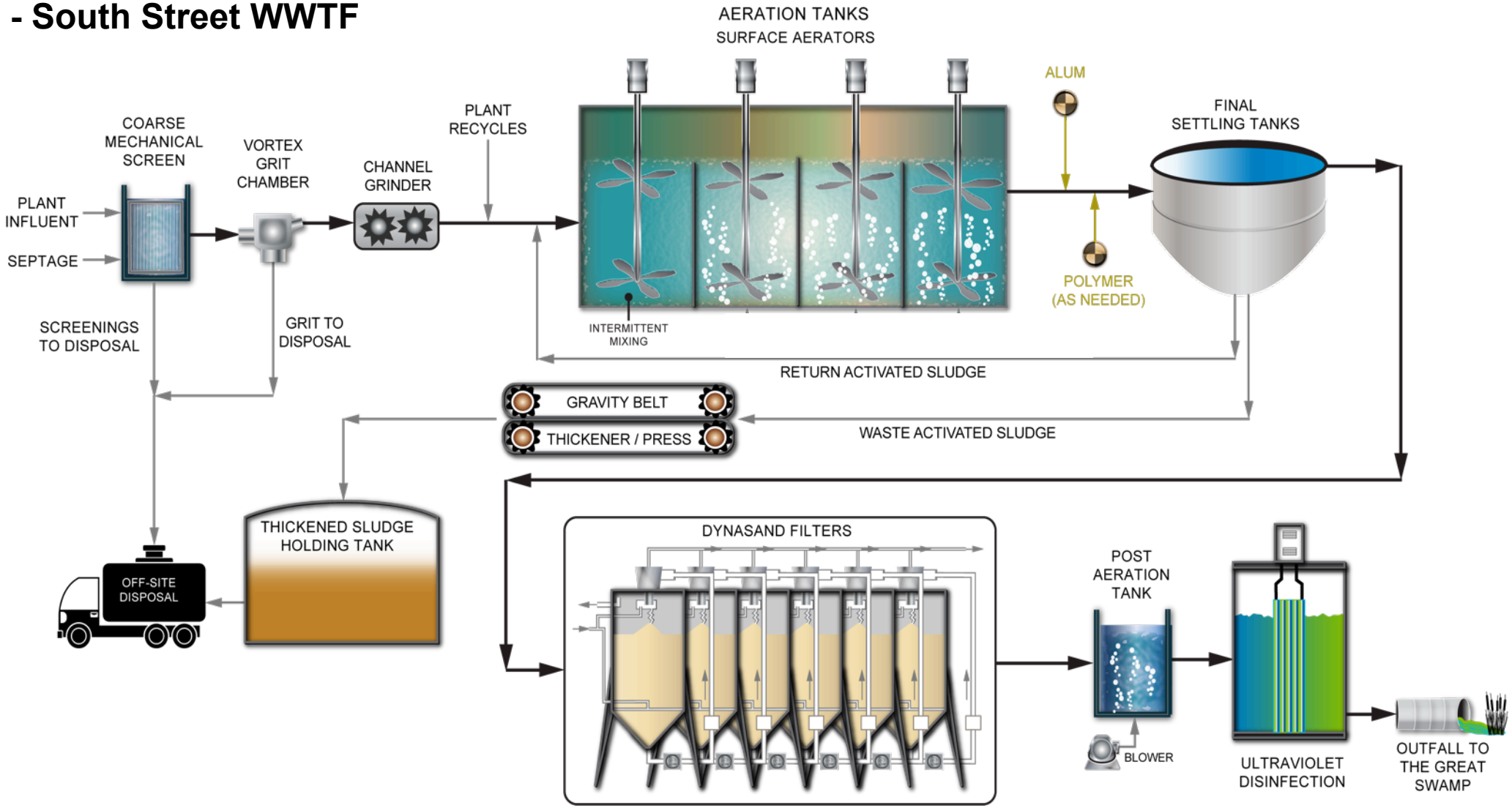
Location: Ridgefield, CT

- Population -25,000
- Sewer District 1 – South Street WWTF
  - 1.0 MGD Average Daily Flow Capacity
- Sewer District 2 –Route 7 WWTF
  - 0.12 MGD Average Daily Flow Capacity
- WWTFs Owned by the Town / Operated by Suez

Project Background

Sewer District 1 - South Street WWTF

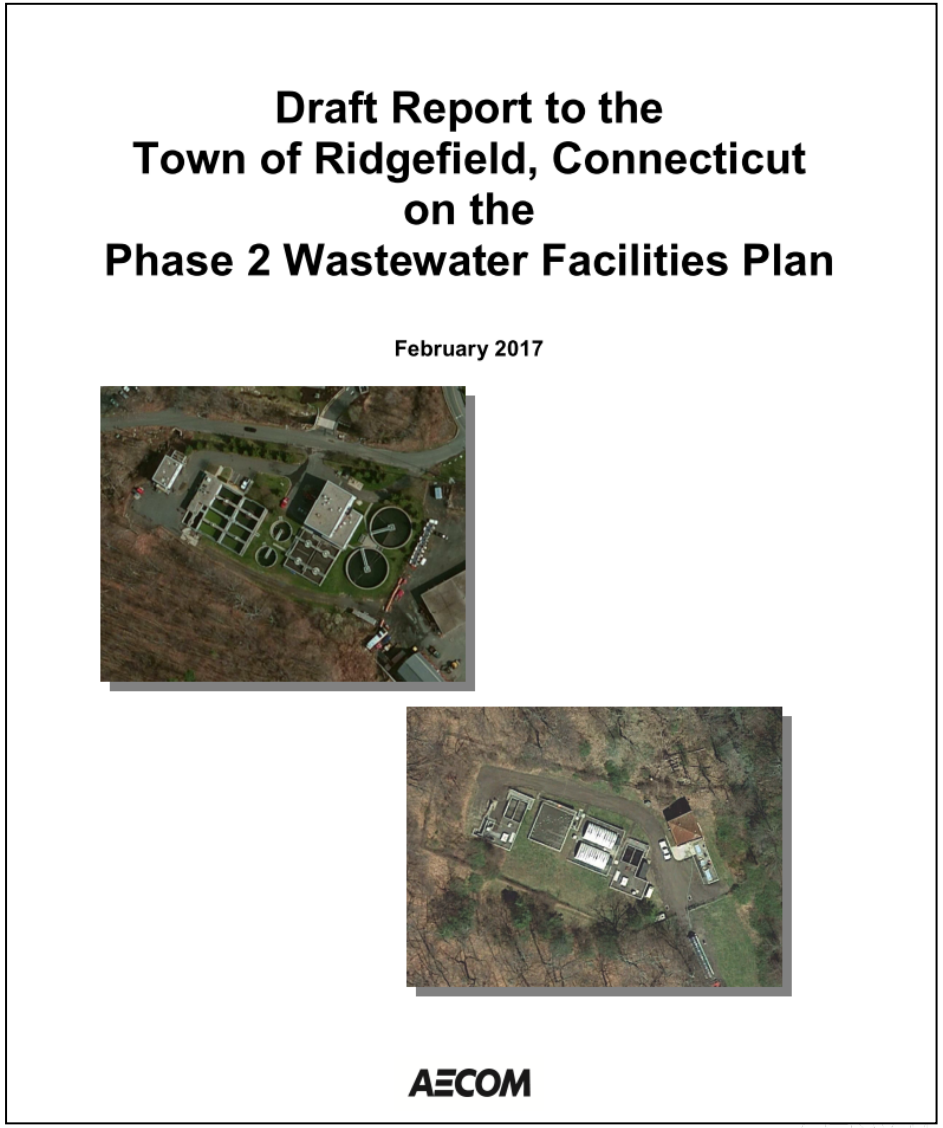
Existing Process Flow Diagram



Project Background

Wastewater System Facilities Plan

– Facilities Plan Drivers
  - South Street WWTF Flows Around the 90% Design Threshold
  - Age of Facilities
    - ✓ South Street WWTF 1989
    - ✓ Route 7 WWTF 1985
  - NPDES Requirements
    - ✓ Seasonal TP Limits for both WWTFs
    - ✓ Nitrogen General Permit (South Street WWTF only)
  - Potential to Consolidate Operations



Project Background

Facilities Plan Recommendation

- Decommission Route 7 WWTF

- Pump Sewer District 2 Flow to South Street WWTF
  - New Pump Station
  - 14,200 lf Force Main

- Upgrade South Street WWTF to Meet New Limits (with increased flows)

- **Life Cycle Cost Savings of ~$3.1M**

Route 7 WWTF

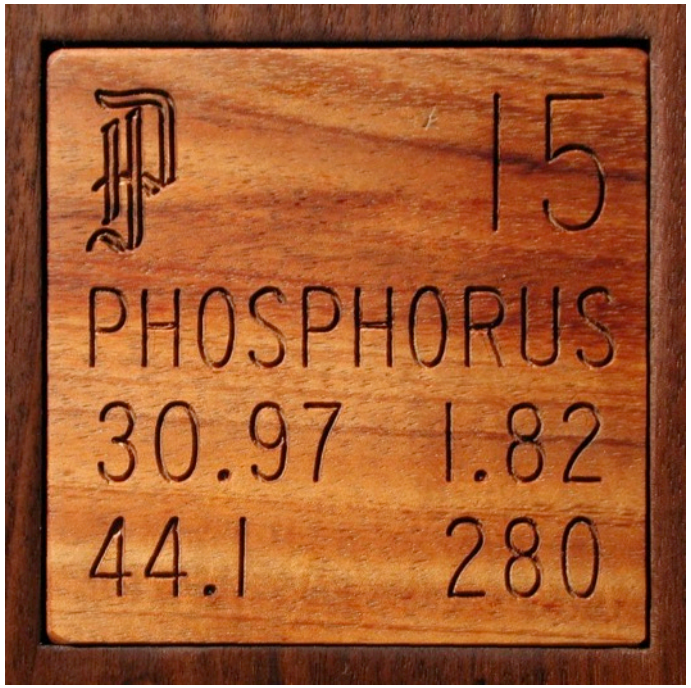
South Street WWTF

Project Background

South Street WWTF Permit Phosphorus Limits

(with Sewer District 1 & 2 Flows):

- **Seasonal Average Total Phosphorus:**
  - 0.52 lbs./day
  - **0.055 mg/l** (at design flow of 1.12 mgd)
- **Monthly Average Total Phosphorus Concentration:**
  - 0.16 mg/l
- **Daily Maximum Total Phosphorus Concentration:**
  - 0.31 mg/l

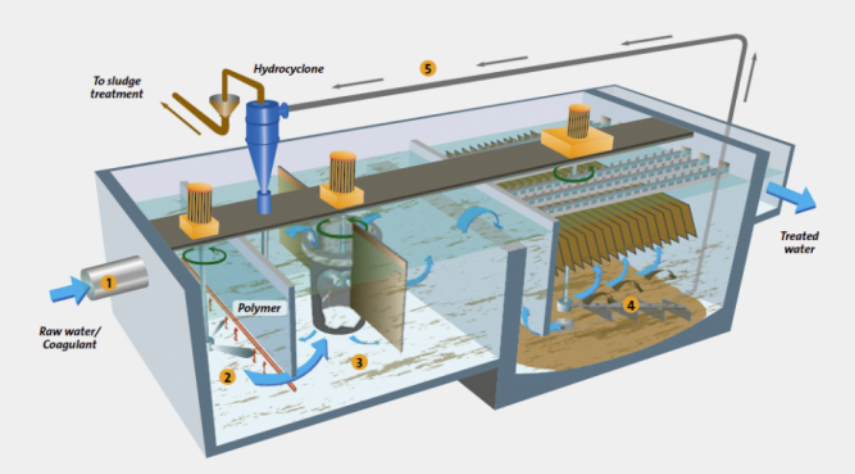


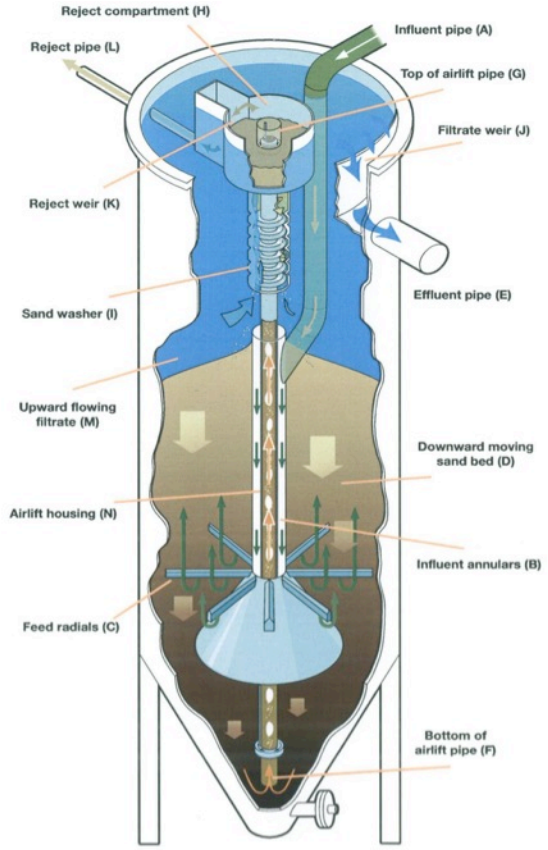
Initial Technology Selection

Initial Technology Selection

Tertiary Phosphorus Removal Technologies Considered

- Ballasted Flocculation
  - Kruger Actiflo
- Continuously Backwashing Sand Filtration
  - Parkson Dynasand
  - Nexom Blue PRO



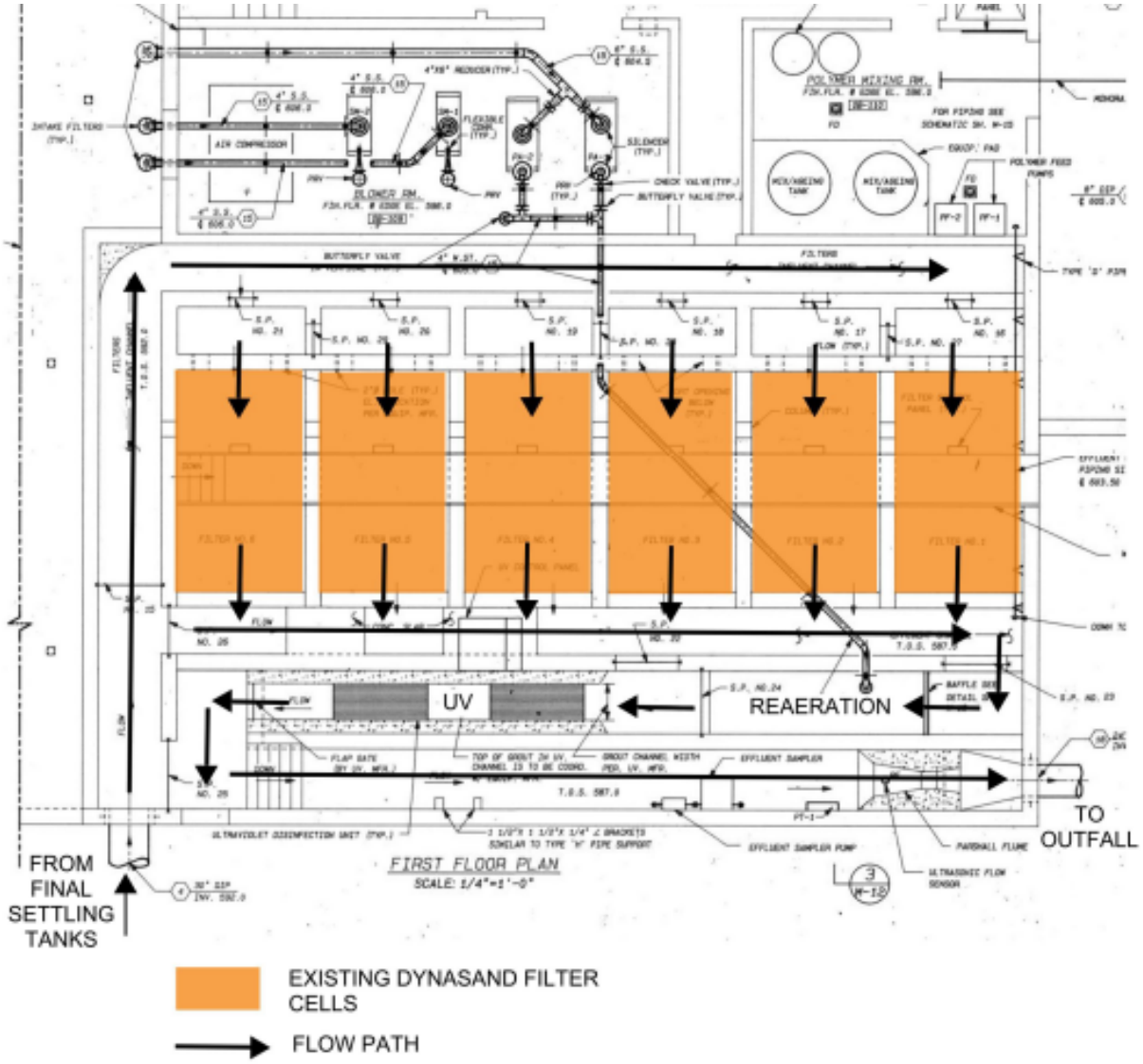


Initial Technology Selection

System Layouts

– Existing Dynasand Filter

- 6 Filter Cells (two modules each)
- Implemented in 1989 WWTF Upgrade for Solids Removal

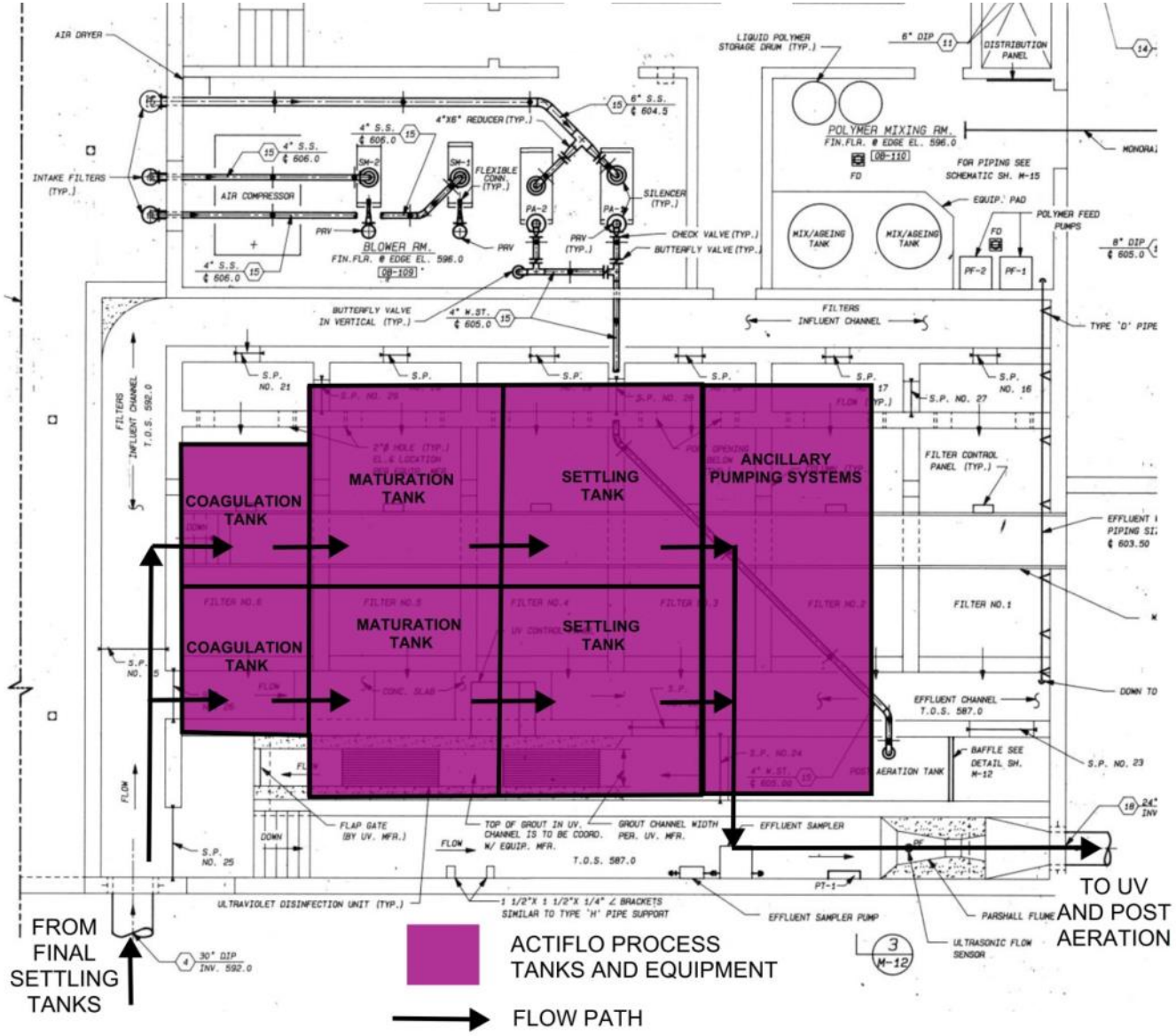


Initial Technology Selection

New System Layouts

– Actiflo

- Two Treatment Trains
- Use Existing Filter Space
- Significant Structural Modifications Required

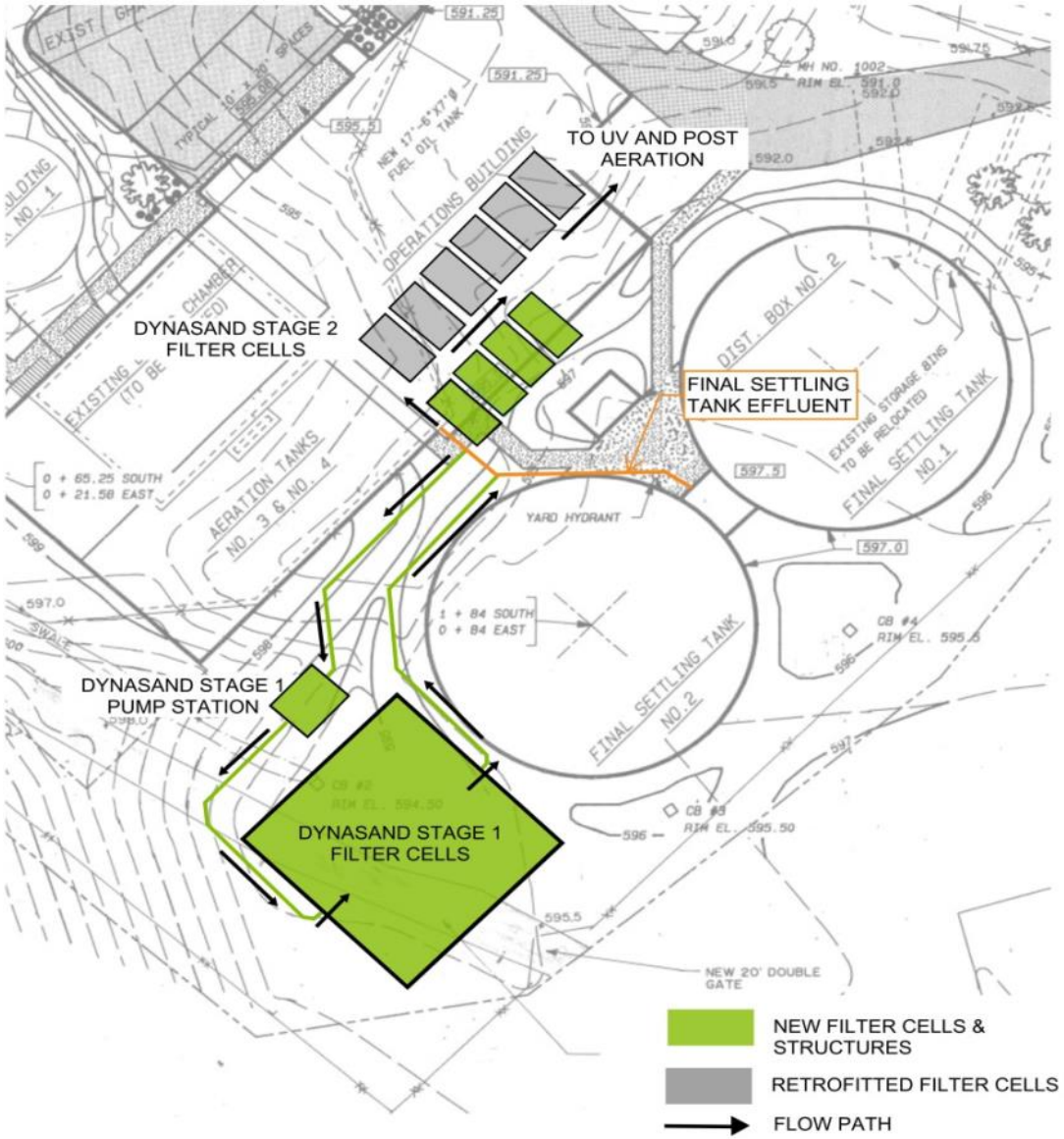


Initial Technology Selection

New System Layouts

– Dynasand

- Two Stage System Required
- Need Intermediate Pump Station

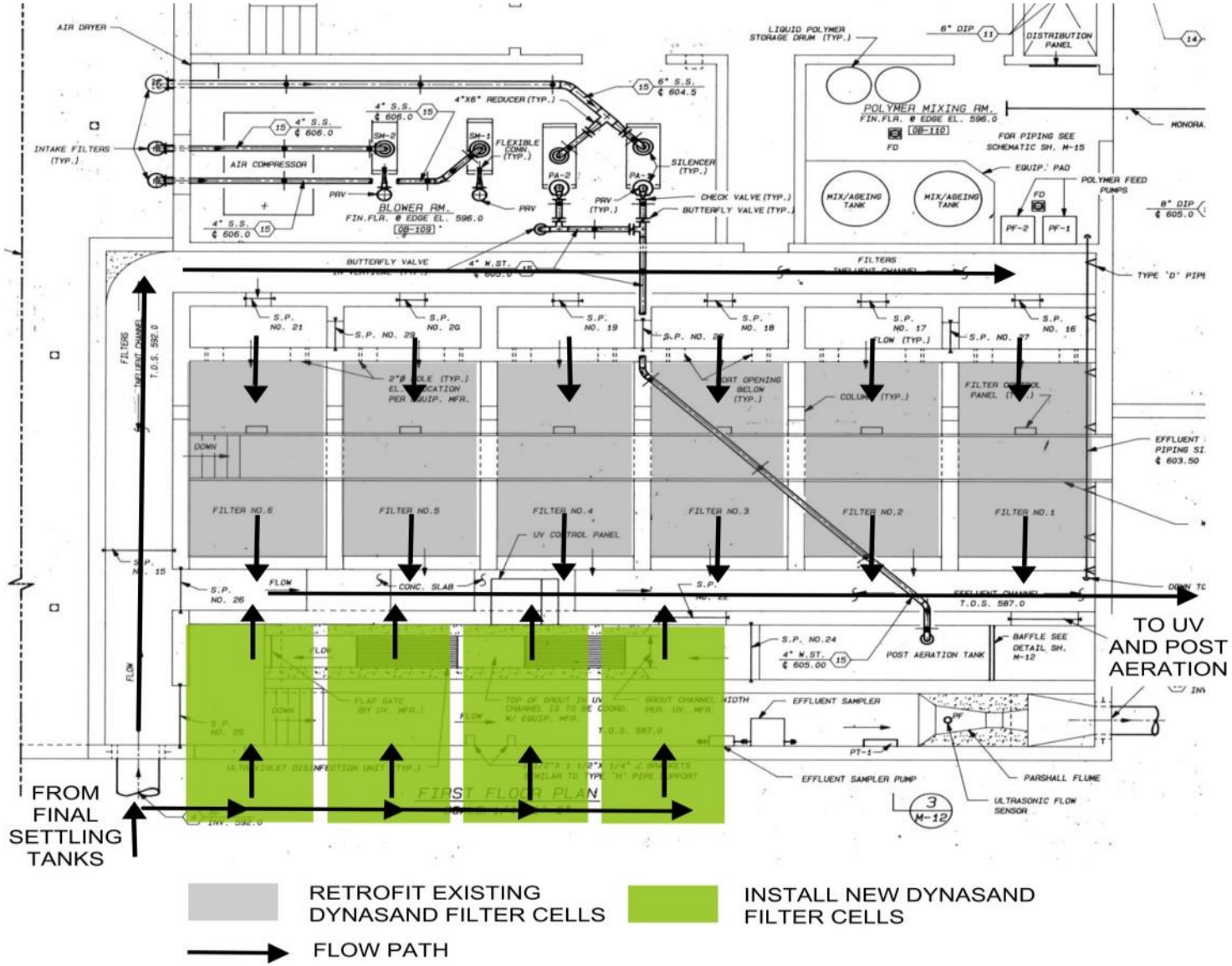


Initial Technology Selection

New System Layouts

– Dynasand

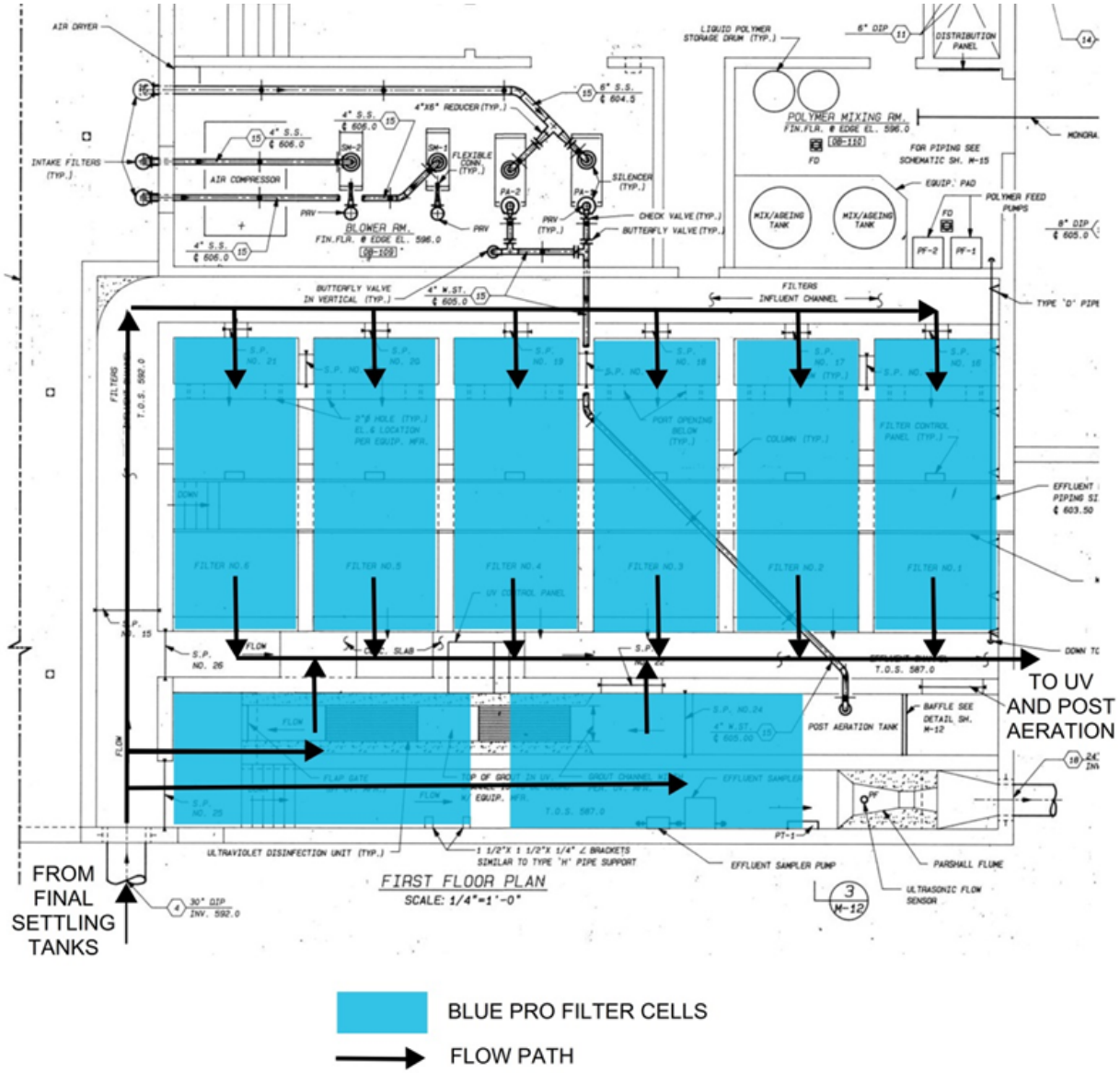
- Each Stage 10 Filter Cells (Two Modules Each)
- Stage 2 Cannot Fit in Existing Filter Area



Initial Technology Selection

New System Layouts

- Blue PRO
  - 8 Filter Cells (Two Modules each)
  - Can Fit Into Existing Filter Space



Initial Technology Selection

Estimated Life Cycle Cost Analysis

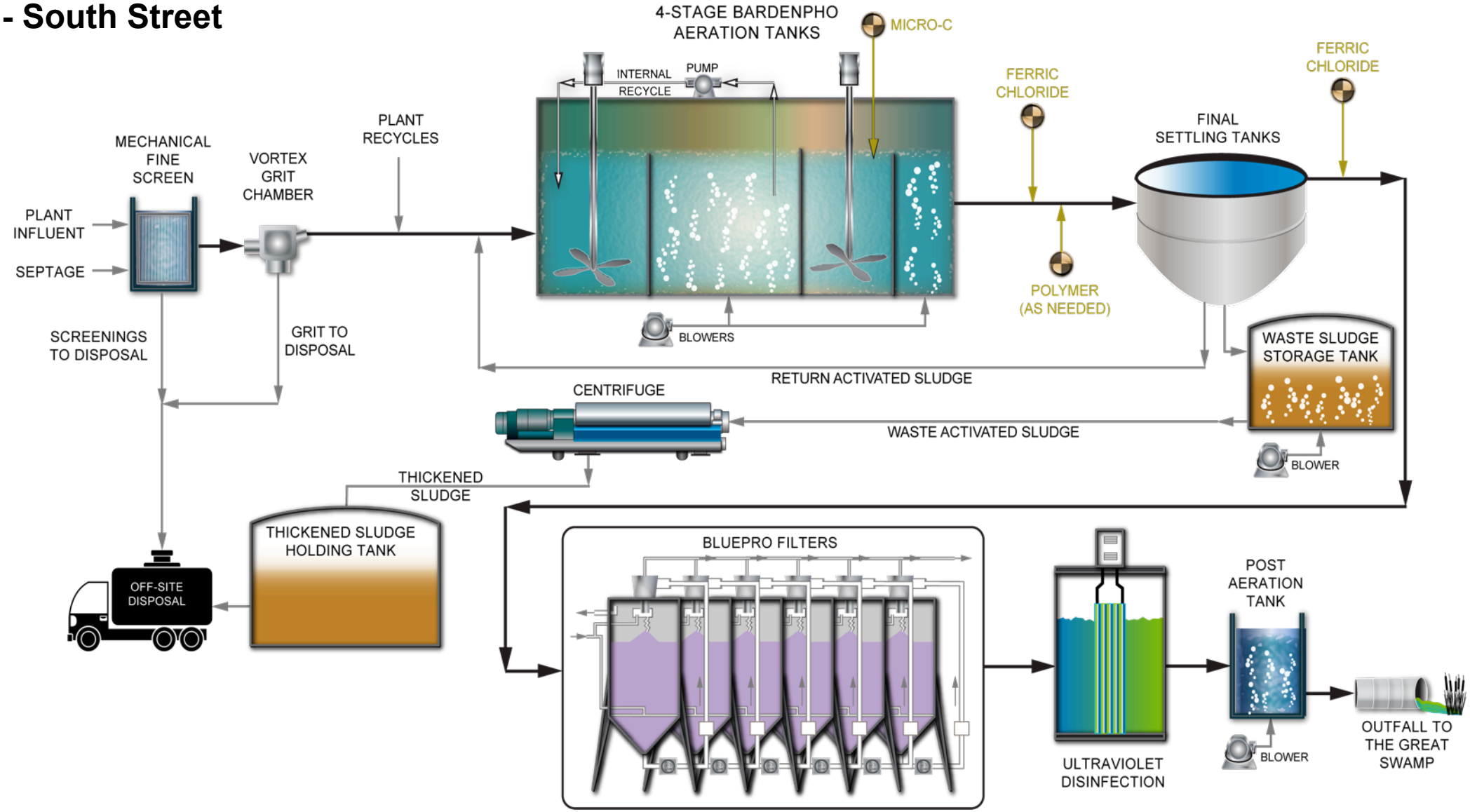
	Process Alternatives		
Costs	**Actiflo**	**Blue PRO**	**Dynasand**
Total Capital Cost	$6.4 M	$3.8 M	$9.6 M
20 Year Present Worth O&M Costs	$2.7 M	$1.3 M	$3.9 M
Total 20 Year Present Worth	**$9.1 M**	**$5.1 M**	**$13.5 M**

Blue PRO Recommended for Implementation

Initial Technology Selection

Sewer District 1 - South Street WWTF

Updated Process Flow Diagram



Initial Technology Selection

DEEP agreement to allow for sole source selection of Blue PRO to advance design

– Unique case where the retrofit of the Blue PRO process into the existing filter cells would require:
  - Minimal Modifications
  - Addition of Only Two Filter Cells

– Preselection Process would:
  - Not Change Technology Selected
  - Add to the Project Cost
  - Add to the Project Schedule

Performance Testing Approach

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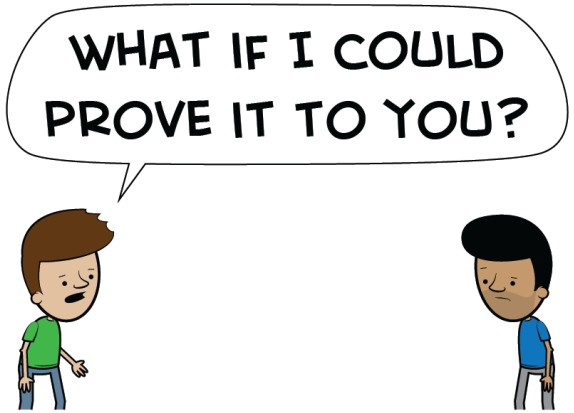
Performance Testing Approach

Performance Verification Testing

- First Step In Design Effort
- Assess Chemical Dosing/Performance
- Increase Confidence at Full Scale to Meet the 0.055 mg/l TP Limit
  - Owner
  - Engineer
  - Blue PRO (Nexom)
  - DEEP
- 60 inch Bed Depth
- Single Stage



Performance Testing Evaluation Approach

Blueleaf, Incorporated

- Pilot Delivery, Commissioning, and Operation with Vendor
- Sampling Collection
- Field and Certified Laboratory Analysis
- Decommissioning
- Data Statistical Analysis
  - 2^2 Factorial Experiment
  - ANOVAs

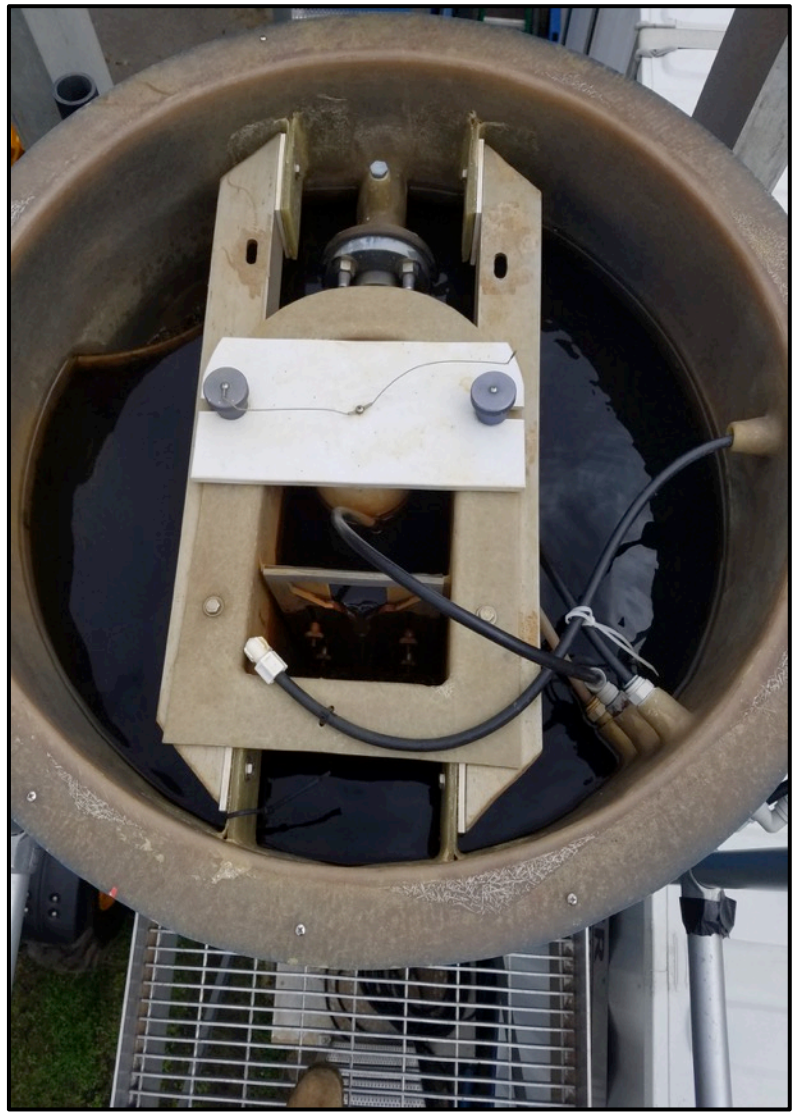
Sample Analysis

- Total P
- Soluble P
- Ortho P
- TSS
- Alkalinity
- Zinc
- Turbidity
- UVT
- Iron

Performance Testing Approach

Phosphorus Goals

- Evaluate the Reduction of Phosphorus:
  - Target Influent TP of 0.5 mg/l
  - Meet a Effluent of 0.05 mg/l
  - Target of 90% TP removal
- Evaluate Impact of:
  - Loading Rates
  - Varying Dose of Ferric Chloride and Polymer



Trial Conditions - Coagulant and Polymer Dose Evaluations

Operating Conditions

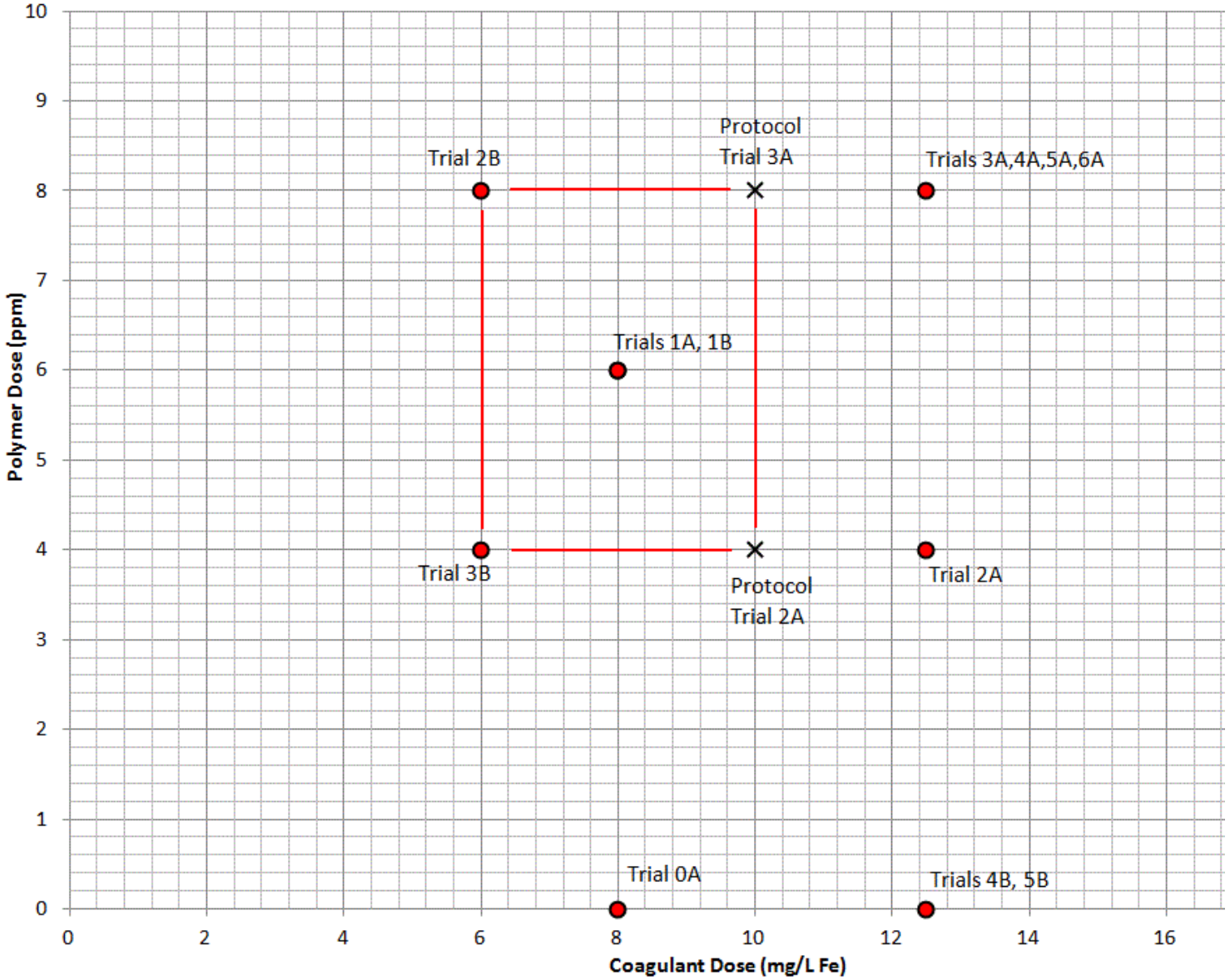
– Trials 1-3 @ 3 gpm/ft2

- 2^2 Factorial Experiment (Modified)

– Trials 4 @ 3 gpm/ft2

- Best Conditions from Trial 1-3 With and Without Polymer

– Trial 5 @ 5 gpm/ft2



Performance Testing Results

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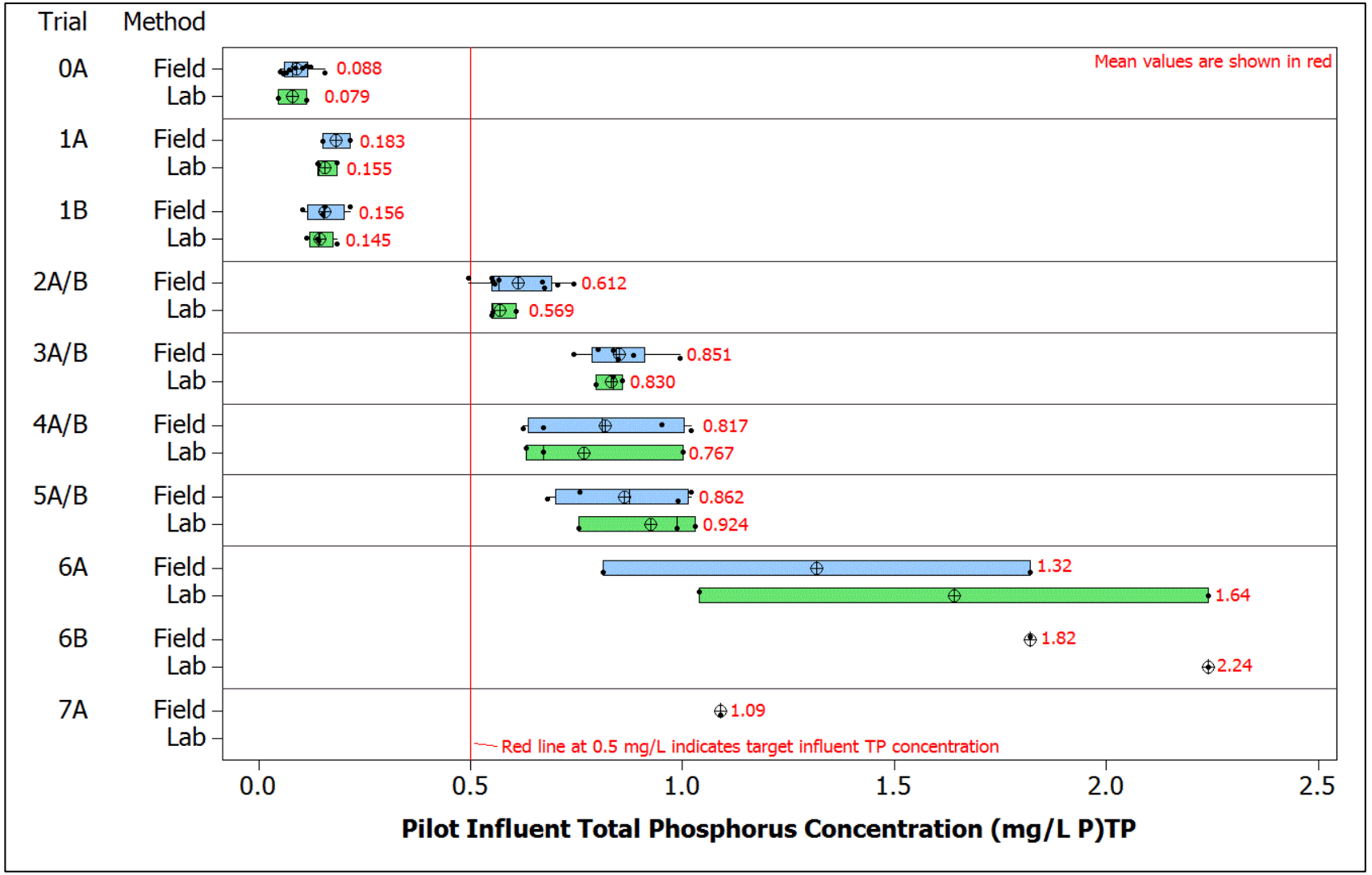
Trial Filter Influent Total Phosphorus Concentrations

Influent Variations

- Final Settling Tank Effluent
- Target 0.5 mg/l TP
- WWTF Operations Adjustments



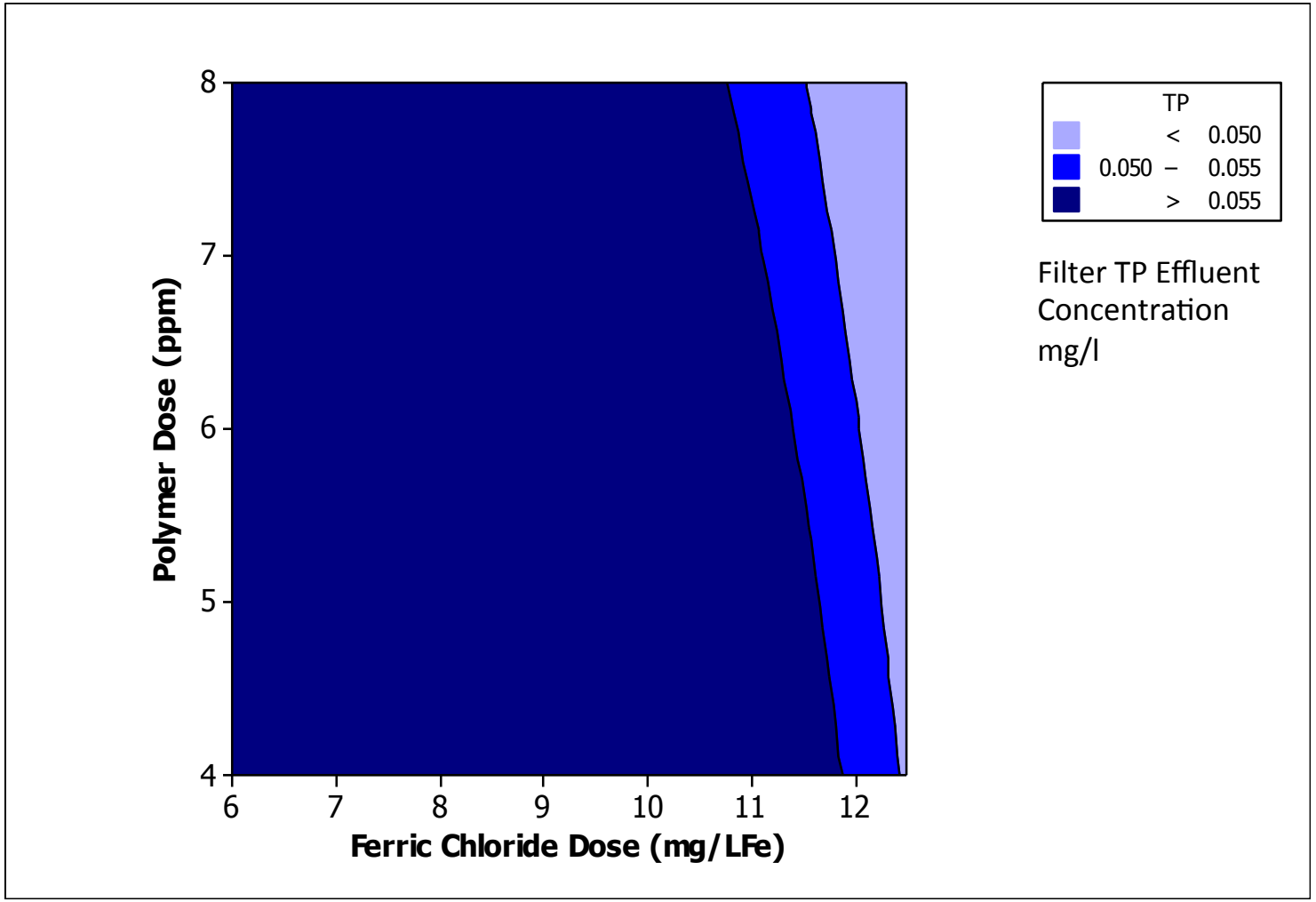
Filter Effluent Total Phosphorus Contour Plot

Operating Conditions

- 3 gpm/ft^2 loading
- Influent TP $\geq$ 0.5 mg/l

Performance

- Met Limit at 12.5 mg/l Fe
- Polymer had Some Impact on Effluent TP



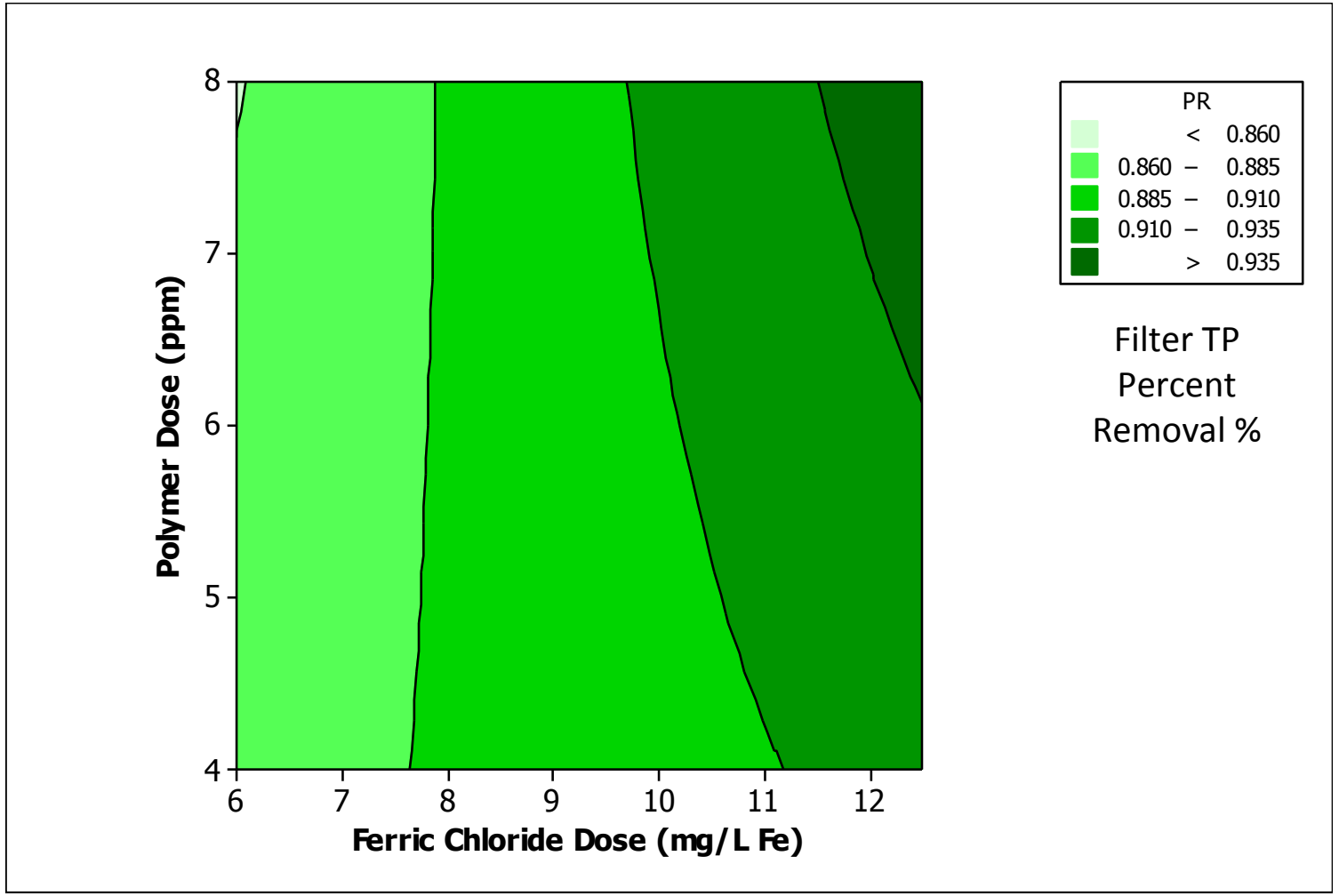
Filter Total Phosphorus Percent Removal Contour Plot

Operating Conditions

- 3 gpm/ft^2 Loading
- Influent TP $\geq$ 0.5 mg/l

Performance

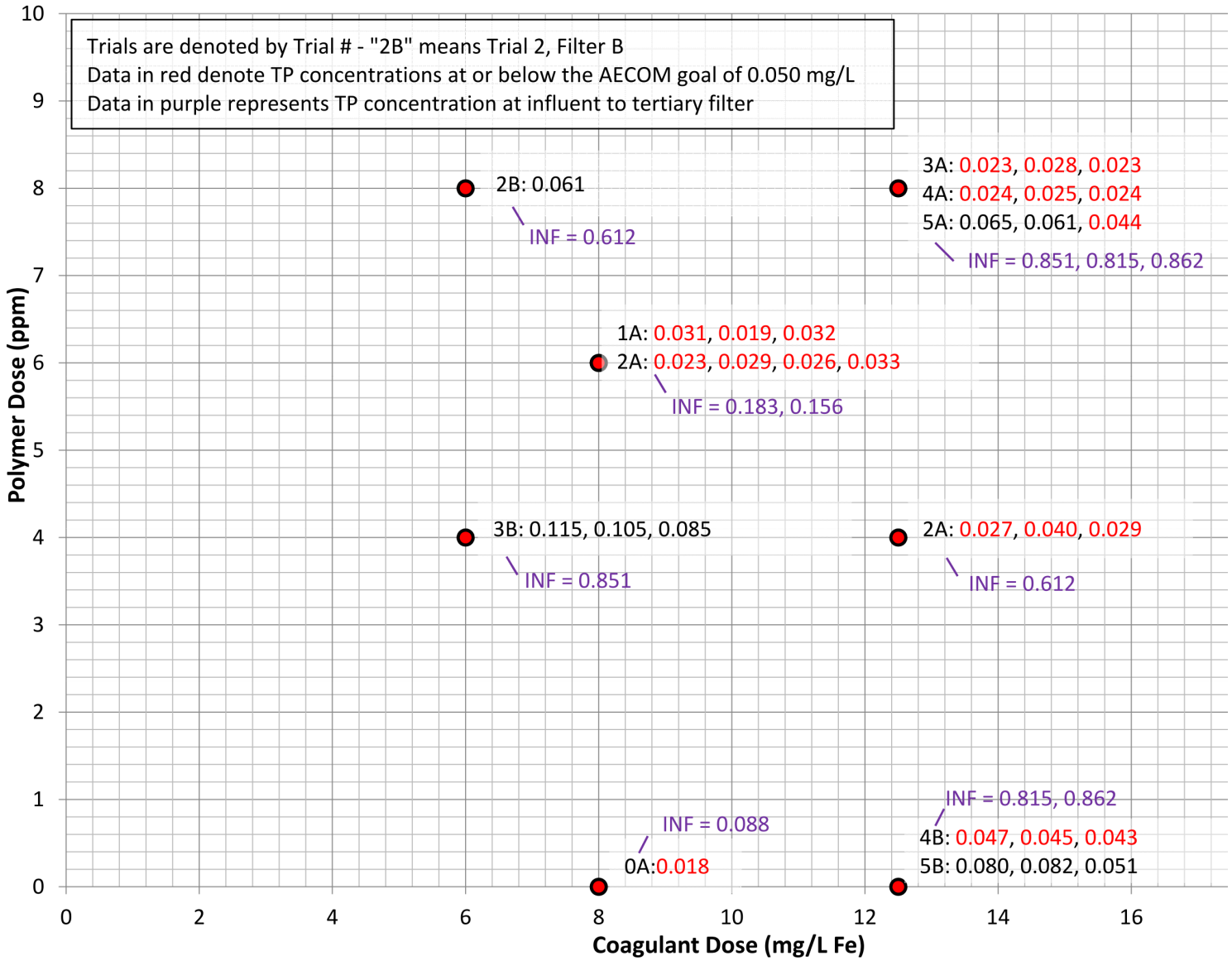
- Fe Impact is Significant
- Polymer Impact More Significant at Higher Fe Concentrations
- Polymer Addition May Allow for Reduction in Fe Dose



Filter Total Phosphorus – Trial Concentrations

Performance

- @ 3 gpm/ft^2 Can Meet 0.05 mg/l at Higher Fe Doses
- Polymer Improves Performance at Higher Fe Doses
- Limited Success to meet 0.05 mg/l at 5 gpm/ft^2 (Trial 5)
  - Peak Day Permit Limit (0.31 mg/l)



Lessons Learned

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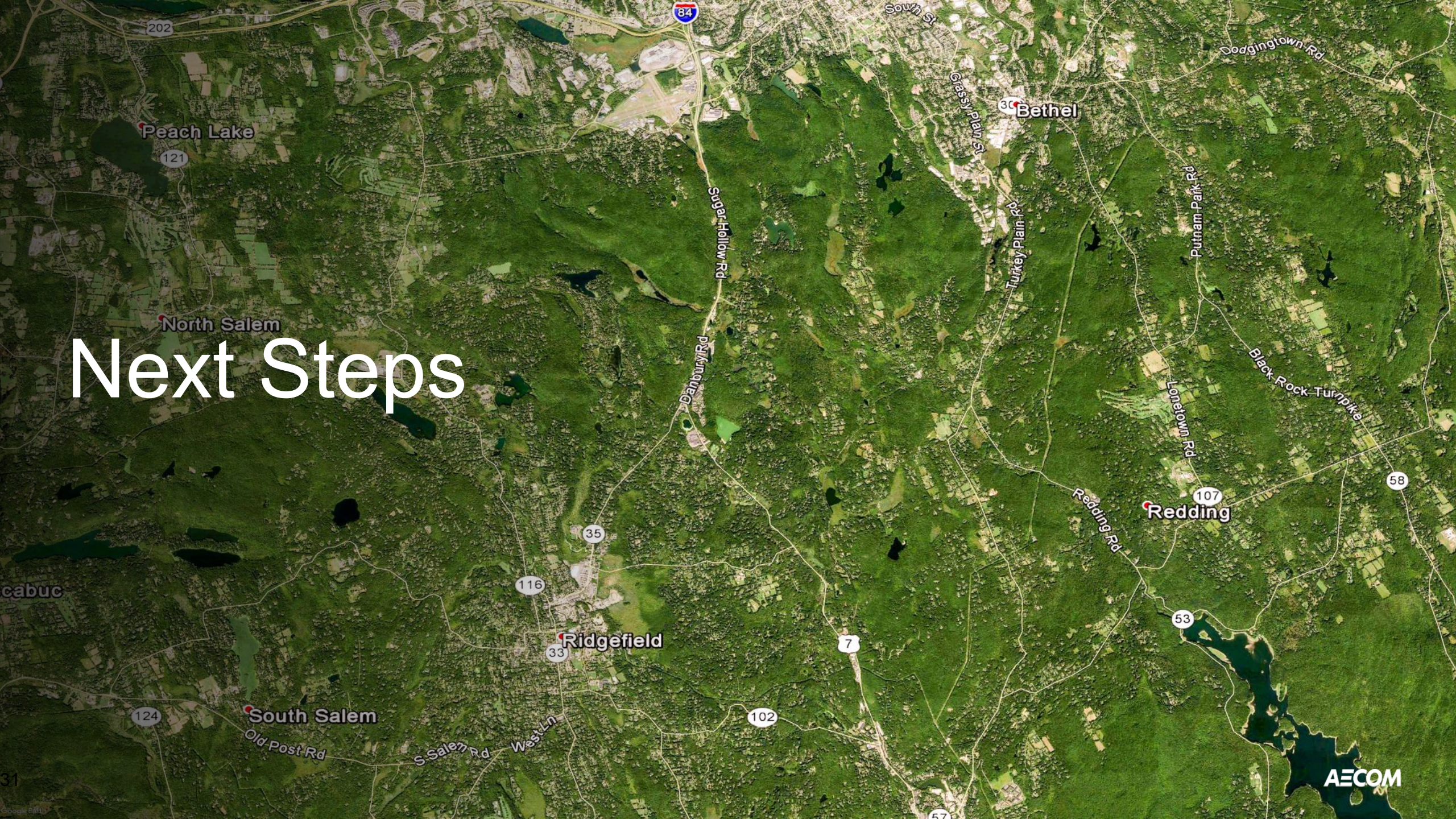
Lessons Learned

- Start Needed WWTF Process Changes Early
- Optimistic vs. Realistic Piloting Schedule
  - Equipment Checkouts
  - Steady State Conditions After Pilot Process Changes
- Invest in Field Testing (in addition to lab testing)
- Be Flexible


Next Steps
Peach Lake
North Salem
Bethel
Redding
Ridgefield
South Salem
Sugar Hollow Rd
Danbury Rd
Grassy Plain St
Turkey Plain Rd
Putnam Park Rd
Dodgingtown Rd
Lonetown Rd
Black Rock Turnpike
Redding Rd
Old Post Rd
S Salem Rd
West Ln
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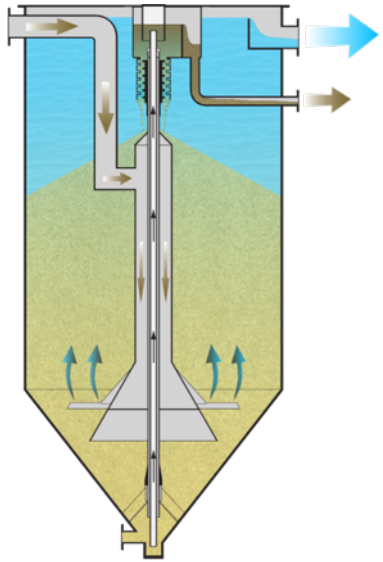
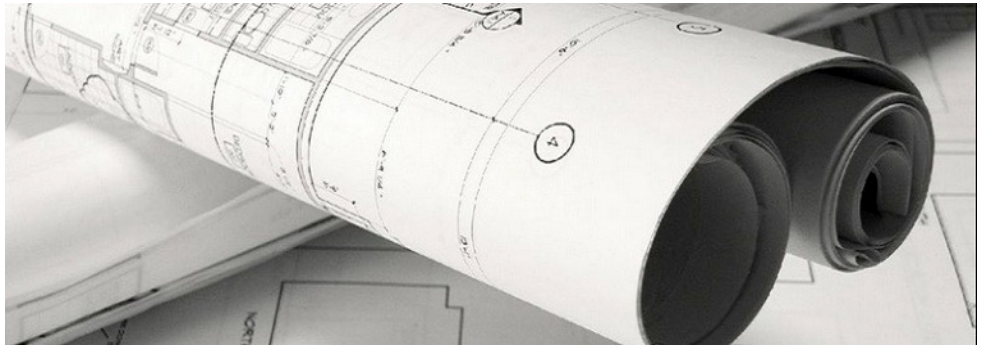
Next Steps – Design and Contract Bidding

- Advancing Blue PRO Process Design
  - Blue PRO (Nexom) to Provide Design Package
  - Blue PRO Scope/Fee/Design Package to be Included in Bid Documents
- Established Parameters for Chemical Dosing (Include Polymer)
- July 1, 2019 Contractor Award Date (DEEP 50% Phosphorus Grant Funding)





Conclusions

Conclusions

- Blue PRO Process Met the WWTF Effluent TP Target of 0.05 mg/l
- Performance Testing Provided Valuable Design Information
  - Ferric Chloride Doses
  - Impact of Polymer on TP Removal
- Increased Level of Confidence that a Single Stage Could Achieve Goals.

Drawing a conclusion!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