VILLAGE OF LIBERTYVILLE WASTEWATER TREATMENT PLANT CHEMICAL PHOSPHORUS REMOVAL IMPROVEMENTS

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Plant Specifications:

- Permitted design average daily flow is 4 mgd.
- Design maximum flow is 8 mgd.
- Two separate plants. Plant A treats 25% of the flow and Plant B treats 75% of the flow.

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Phosphorus Effluent Reduction Improvements

- Mandated by IEPA Permit to be at 1.0 mg/l (monthly average) by April 1, 2020.

- Currently at approximately 4 mg/l (monthly average).

- Phosphorus Reduction Feasibility Study indicated that chemical treatment is most cost effective measure to meet compliance standards.

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Phosphorous Removal Feasibility Study

ALTERNATIVES

- A/O
- A^2O Processes
- Sequential Batch Reactor (SBR)
- University of Cape Town Process (UCT)
- Virginia Initiative Process (Mod. UCT)
- Phostrip II (extended Phostrip)
- 3 Stage Westbank process
- 5 stage Bardenpho Process
- Membrane Biological Reactor (MBR)
- EBPR w/ VFA Addition
- Chemical Precipitation

CONSIDERATIONS

- Influences of recycle flow (nitrites)
- COD/P - BOD/P Ratios
- Effectiveness for Reliable TP Removal
- Carbon Source (cost)
- Substantial Capital Costs
- Complexity & Manpower
- Maintenance Costs
- Operational Costs
- Operational Problems (foaming & washout during peak flows)

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Phosphorous Feasibility Study

- Evaluated Biological & Chemical Treatment Technologies

  Biological: A^2O, UCT and MUCT Processes

  Chemical: Alum, Ferric Chloride and PAC Addition

- Bio-Win Modeling indicated wastewater characteristics could not support bio treatment with out addition of carbon source
- Bio process requires major plant modification 2 plant within the plant.
- 20 Year Present Worth Analysis: Chemical Addition lowest cost

  - A^2O Process = $27.9 Million
  - UCT Process = $32.4 Million
  - MUCT Process = $31.2 Million
  - Chemical Addition = $12.5 Million

CHEMICAL vs Biological P REMOVAL

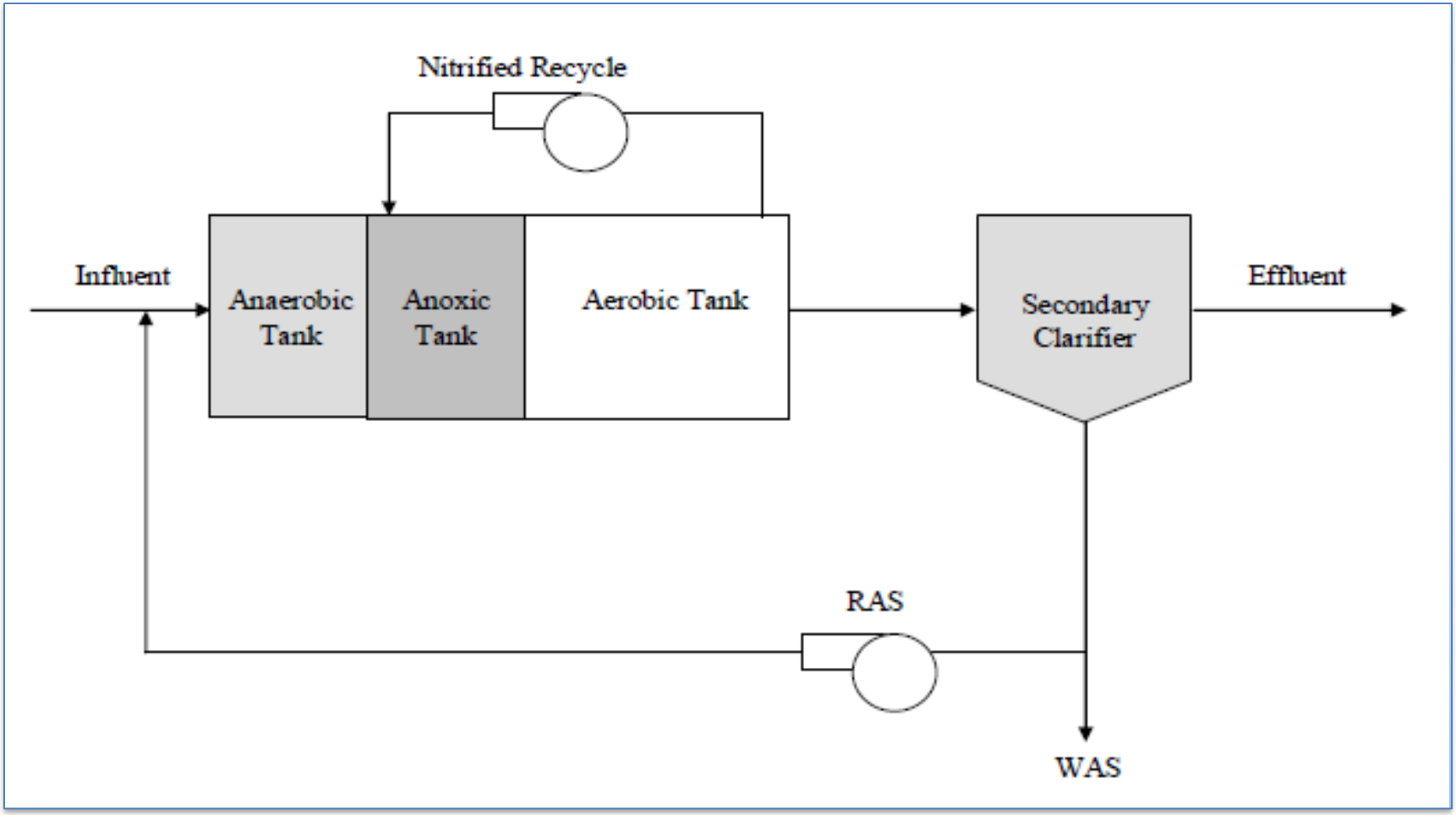
Chemical P Removal

- Consistent Performance
- Less disruptive/simpler operation
- Additional operational cost for chemical & residual disposal
- Nuisance precipitates
- Redundancy back-up to bio P (future)

Biological P Removal

- Lower Operational cast
- Creates opportunity for P recovery
- Requires additional bioreactor volume ($$$)
- Dewatering Impacted
- Nuisance precipitates

Typical Biological Process



Phosphorus Effluent Reduction Improvements

- Chemical Phosphorous Removal chosen method.
- The Village is pursuing financing through the IEPA's Water Pollution Control Loan Program.
- Project is currently being solicited for competitive contract bids.
- Estimated total (engineering & construction) project cost is $2,770,000.

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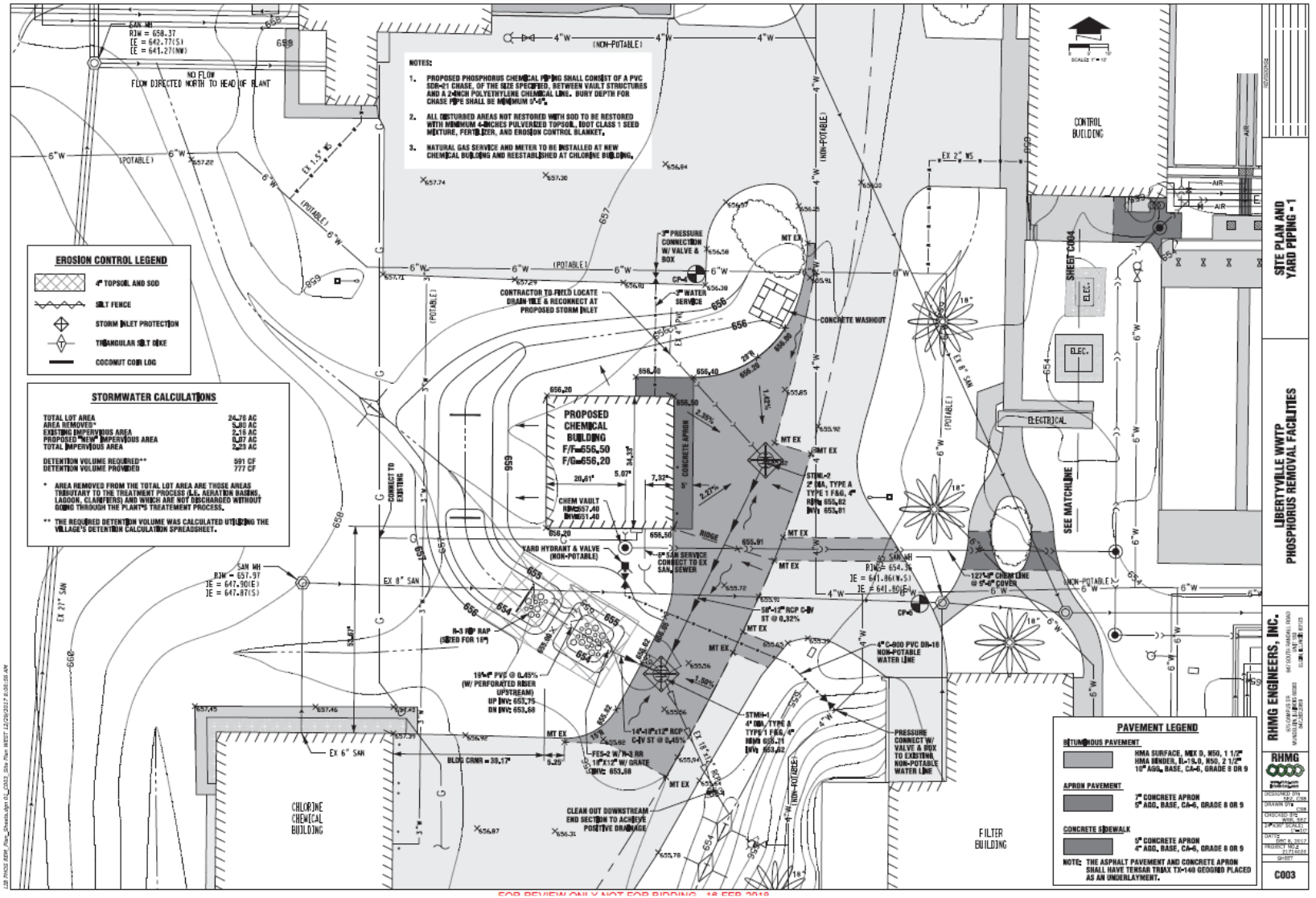
CHEMICAL P REMOVAL

- Phosphorous is removed by adding metal coagulants (alum/Ferric) through co-precipitation and adsorption.
- Transforms soluble phosphorous to particulate form.

- Secondary Treatment solid-liquid separation P incorporates into the biomass removed by wasting.

Proposed Chemical Building



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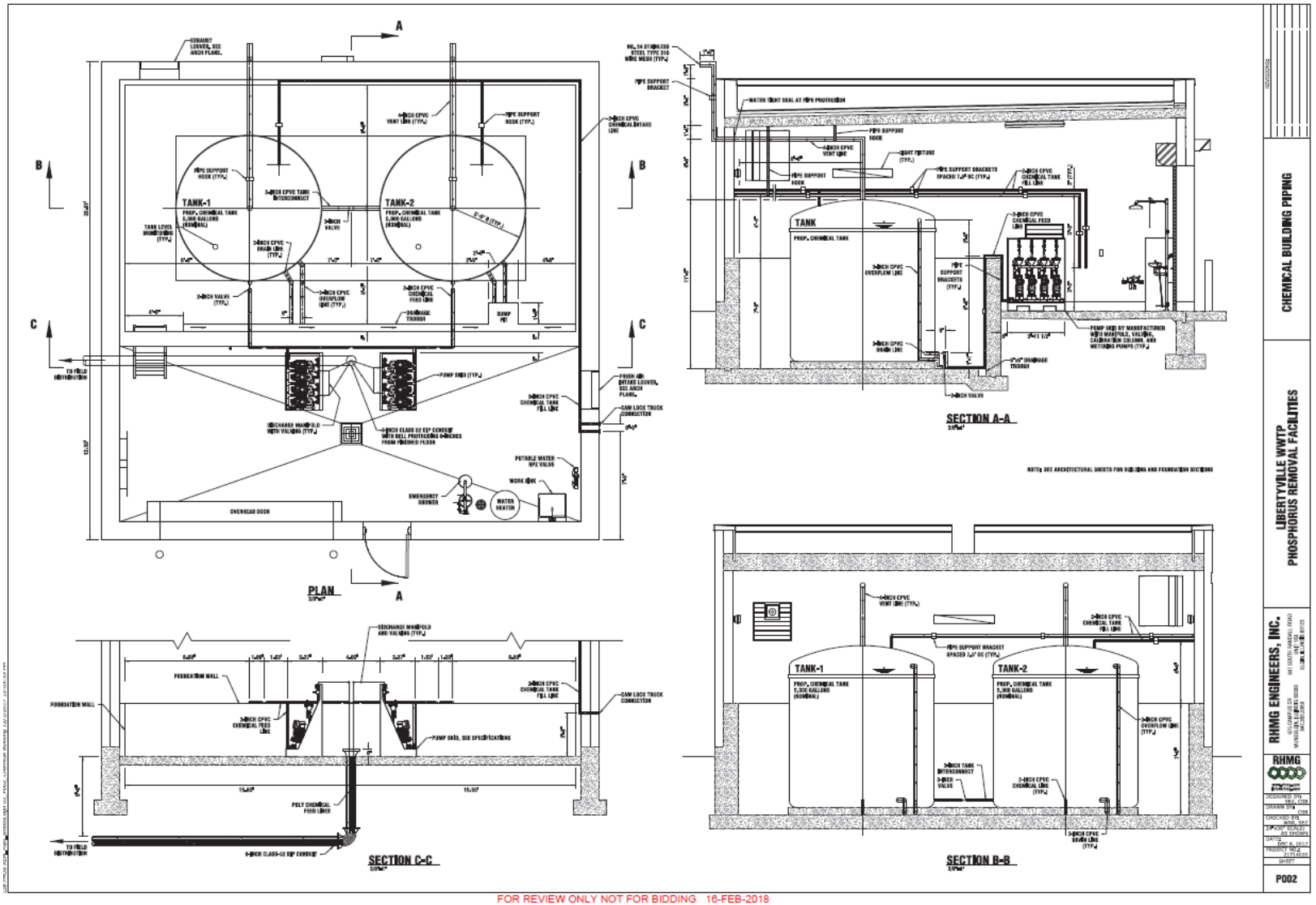
Proposed Chemical Building Piping Plan



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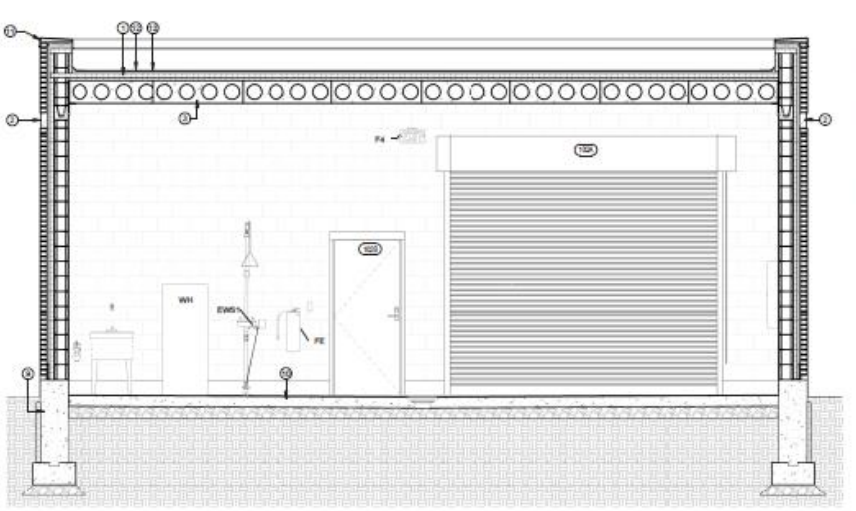
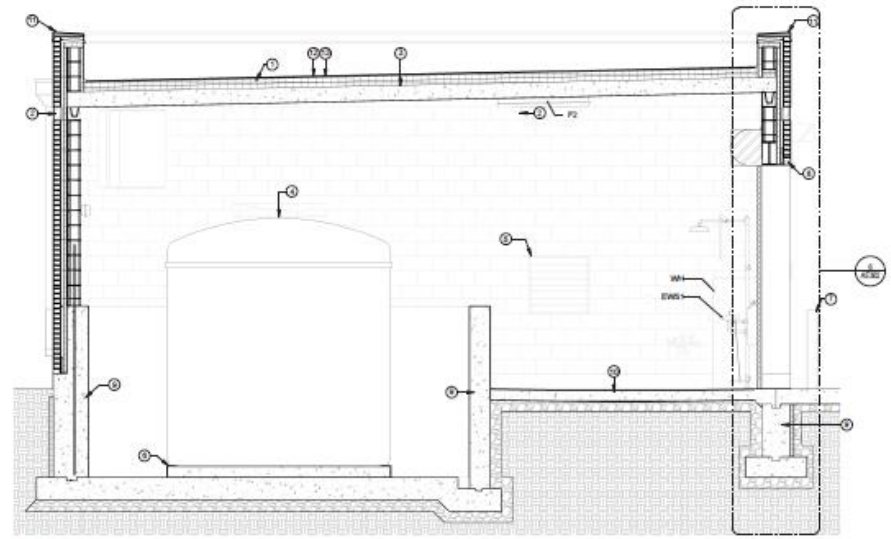
Proposed Chemical Building Sections



1 BUILDING SECTION
3/8" = 1'-0"



2 BUILDING SECTION
3/8" = 1'-0"

KEYNOTES

1. Rigid roof insulation, R30-CI min.
2. Face brick, M-1, set in soldier course pattern.
3. Precast hollow core planks. Reference Structural drawings.
4. New chemical storage tank. Reference process piping drawings.
5. Fresh air intake louver. Color to match paint color P-3. Reference mechanical drawings.
6. 6" housekeeping pad. Reference sections and structural drawings.
7. New 6" steel pipe bollard. Fill entire length of pipe with concrete. Provide "Post Guard" bollard cover in safety yellow with red stripes over each bollard.
8. Face brick M-1 set in rowlock course above overhead doors.
9. Concrete foundation wall. Reference structural drawings.
10. 6" thick concrete floor. Reference Structural drawings.
11. Bent metal coping cap with factory applied finish to match paint color P-3.
12. Reinforced TPO roofing membrane.
13. 1/2" or 5/8" insulation overlayment cover board.

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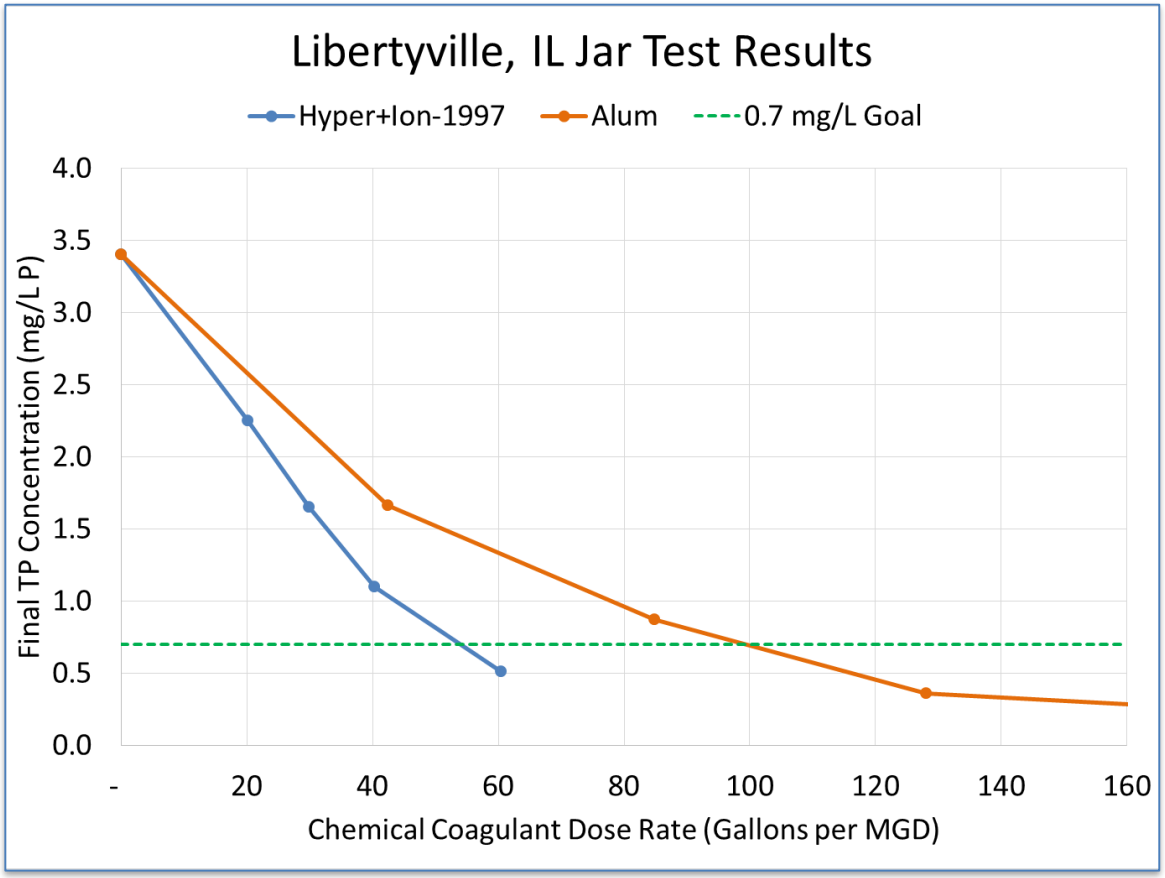

ALUM JAR TEST RESULTS

0.75 mg/l (target) = 98 gal./mgd x 3.75mgd = 368 gpd

368gpd x $1.00/gal. = $368/day $368/day x 365 day/yr. = **$134 k/yr**.

34 truckloads/yr. or 1 truckload/1.5 weeks

All are Welcome to Visit us!

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Questions?

Paul Kendzior, P.E., C.F.M. Director of Public Works and

Steve Vella, WWTP Superintendent

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