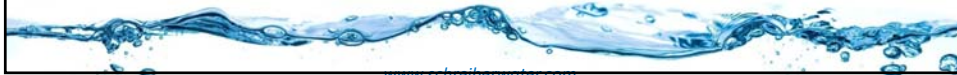




Compressible Media Filter (Schreiber Fuzzy Filter)

Ayman Shawwa, *Ph.D., P.E., BCEE, PMP*



Presentation Outline

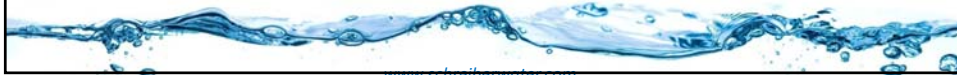
- Compressible Media Filtration Technology
- Fuzzy Filter for Tertiary Phosphorus Removal
- Fuzzy Filter for Carbon Diversion
- Discussion



High-Rate Filtration Technology



- Tertiary treatment
- Water reuse (Title 22)
- CSO treatment
- Industrial applications
- Primary effluent filtration



Schreiber Fuzzy Filter



Compressible
Synthetic Media

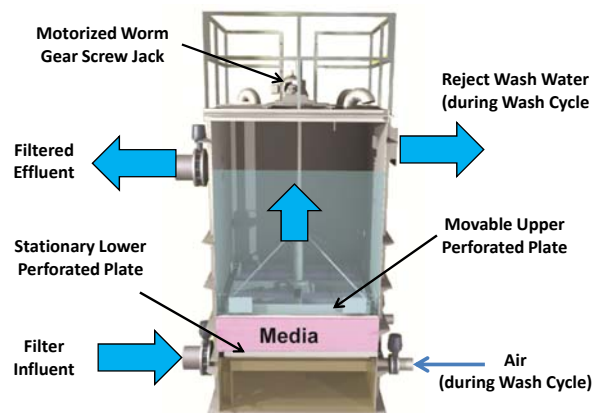


Filter Media Properties

- Made from a high grade Polymer – PPS polyphenylene sulfide
- Resistant to heat, acids, bleaches, aging, sunlight, and abrasion
- Easy to clean
- Highly porous with 85 % void ratio
- Proven Life of 10+ years!

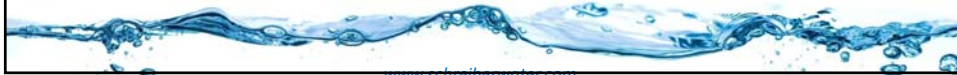


Simple Filter Design



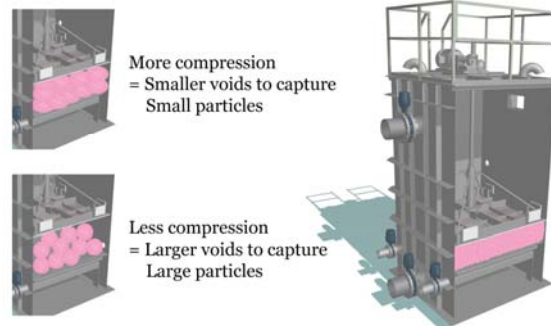
Design Features

- High filtration rate (30 to 40 gpm/ft²)
- Inlet pressure < 8 psi - Gravity effluent discharge
- Solids storage capacity 1.2 lbs solids / cu. ft of media
- Influent water is used for washing filter media
- Low reject wash water (< 5%)
- Media compression up to 40% - High removal efficiency of small particles (5 microns)



Media Compression

Compression changes porosity in filter bed



$$\text{Media Compression Ratio (CR)} = 1 - \frac{\text{Compressed Media Depth}}{\text{Uncompressed Media Depth}}$$



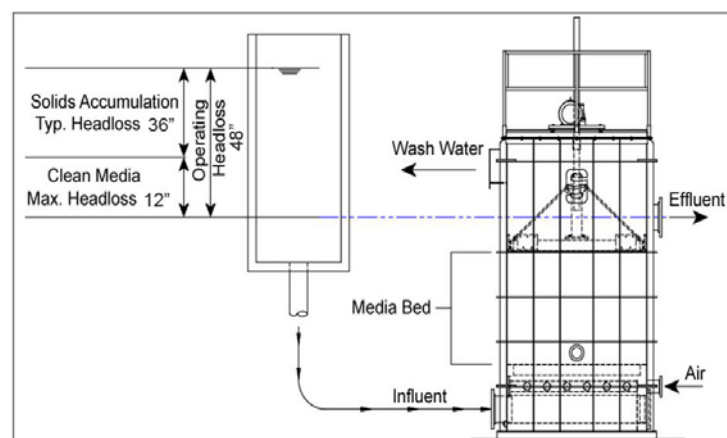
Reject Wash Water Ratio

$$RWW \text{ ratio } \% = \frac{W_W}{(W_W + W_F)} \times 100\%$$

Where W_B is wash water and W_F is total filtered water

- Conventional filters RWW ratio is 6-15%
- Fuzzy filter RWW ratio is 2-4%

Max. Operating Headloss



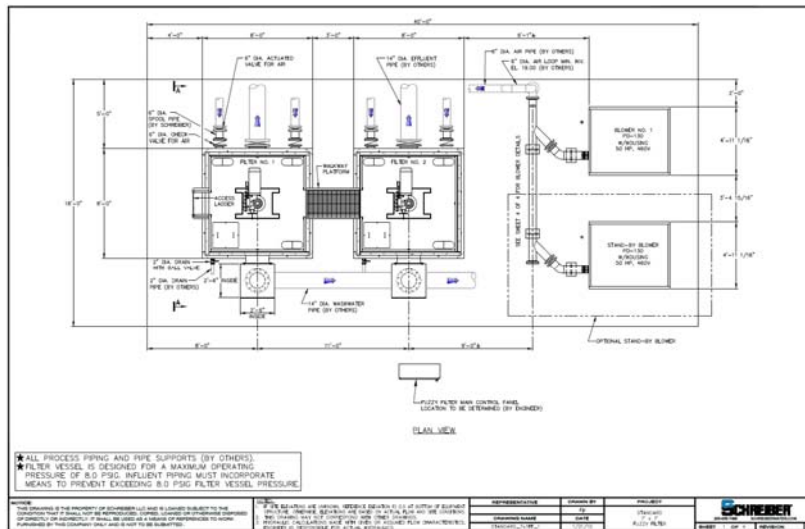
Standard Filter Vessel

Filter Model	Design Flow @ 30 gpm/ft ²	
	gpm	mgd
18" x 18"	67	0.10
2' x 2'	120	0.17
3' x 3'	270	0.39
4' x 4'	480	0.69
5' x 5'	750	1.08
6' x 6'	1080	1.56
7' x 7'	1470	2.12
8' x 8'	1920	2.76

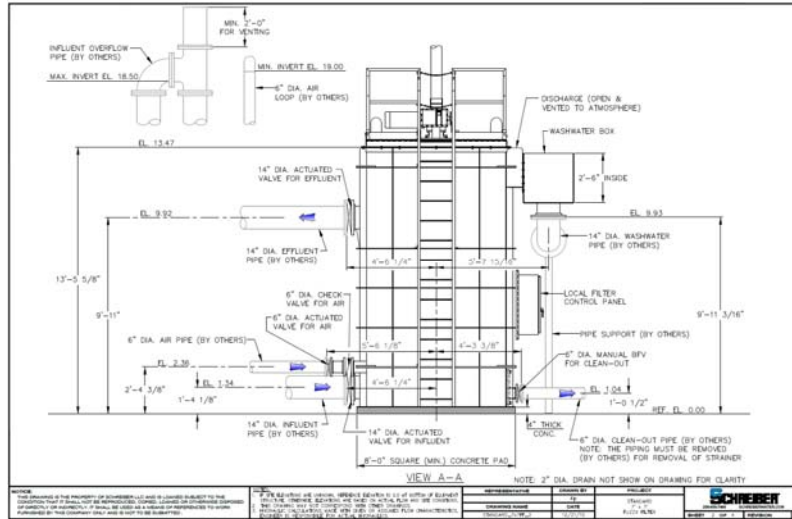
- Vessel material:
 - Hot dip galvanized steel
 - Epoxy coated carbon steel
 - 304 stainless steel



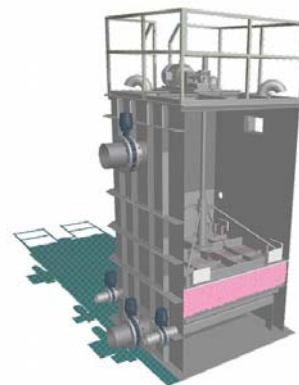
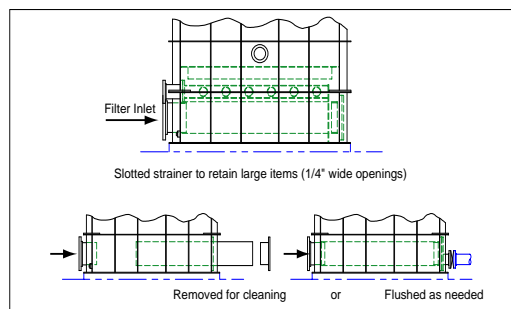
Standard 7'x7' Filter



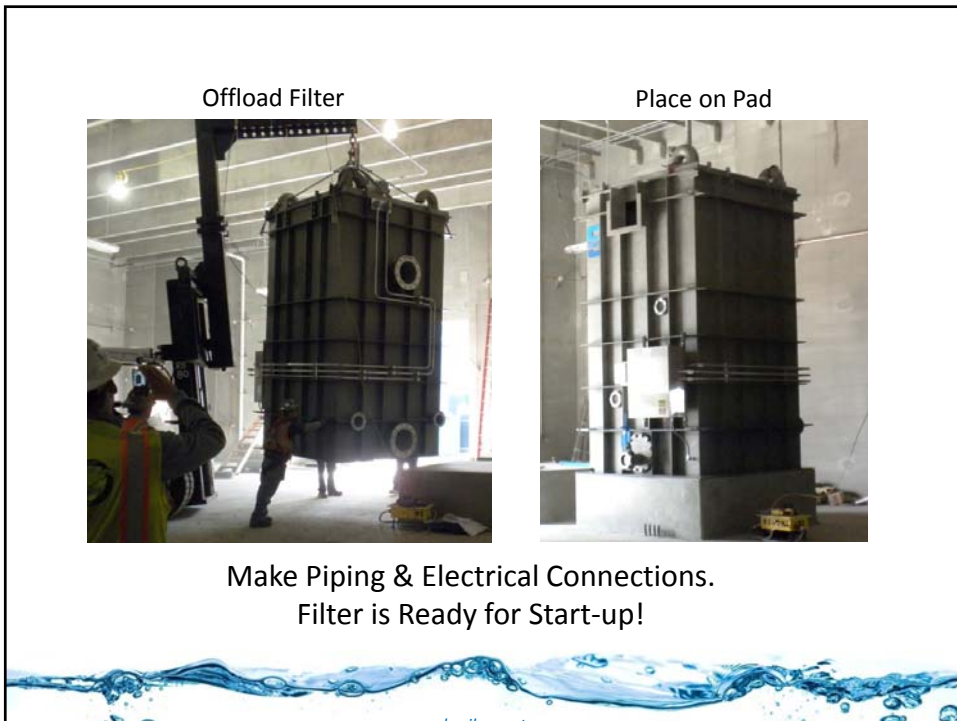
Standard 7'x7' Filter



Inlet Strainer



Stainless steel strainer (with 0.25" openings) traps larger solids to protect filter media



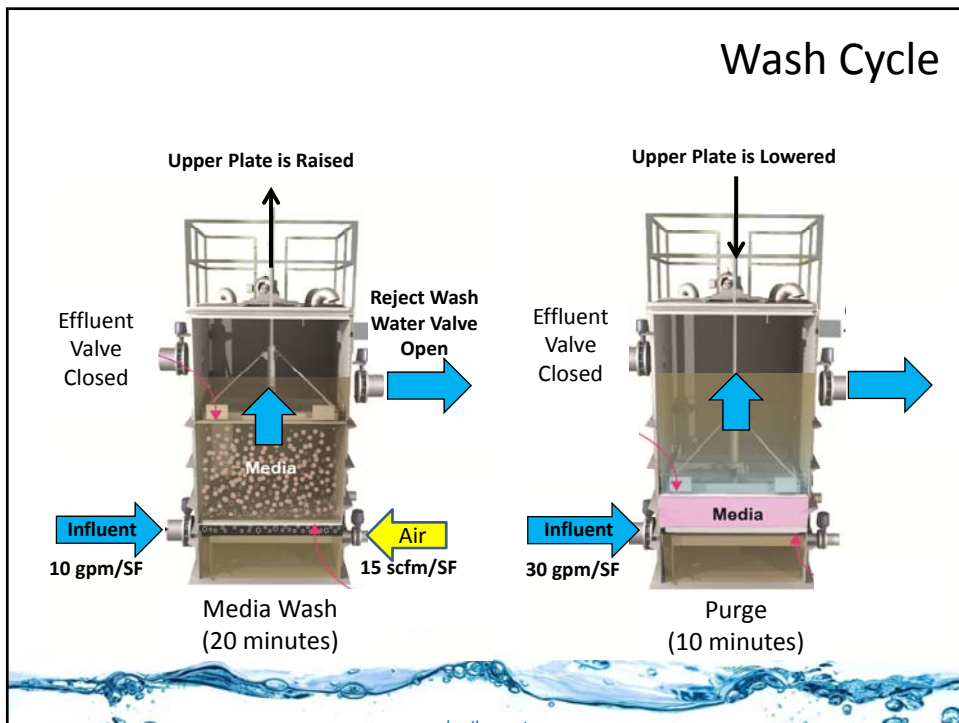
Termination of Filtration Cycle



- Medium head loss reaches a preset level (e.g. 7 psi)
- Effluent Turbidity reaches a preset value (e.g. 1.9 NTU)
- Preset filtration cycle time (e.g. 8 hours) is met



Wash Cycle

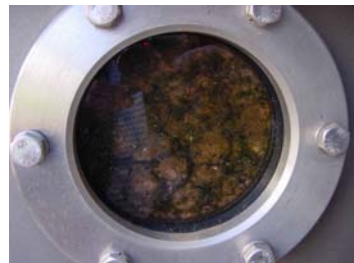


Wash Cycle Demo




Filter Media Maintenance

- Media deep cleaning with bleach and detergent is highly recommended every 12 months
- Customized detergent formulation determined through lab testing



Limits of Phosphorus Removal

Phosphorus Removal Process	Effluent TP Concentration
Biological phosphorus removal	TP > 1.0 mg/L
Chemical addition before secondary clarifier (co-precipitation)	TP < 1.0 mg/L and > 0.5 mg/L
Co-precipitation followed by tertiary phosphorus removal technology	TP < 0.5 mg/L and > 0.1 mg/L
 Chemical treatment after secondary clarifier followed by tertiary phosphorus removal technology (post-precipitation)	TP < 0.1 mg/L and > 0.05 mg/L

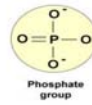
Tertiary P Removal Technologies

Tertiary Phosphorus Removal Technology	Commercial Name	Manufacturer
Compressible Media Filter	<ul style="list-style-type: none"> Fuzzy Filter WWETCO FlexFilter 	<ul style="list-style-type: none"> Schreiber Westech
High-Rate Clarification	<ul style="list-style-type: none"> Actiflo AquDAF CoMag 	<ul style="list-style-type: none"> Veolia Suez Evoqua
Continuous Backwash Sand Filters	<ul style="list-style-type: none"> Blue PRO DynaSand 	<ul style="list-style-type: none"> Blue Water Parkson
Cloth Media Filters and Disk Filters	<ul style="list-style-type: none"> AquaDiamond AquaDisk Hydrotech Discfilter 	<ul style="list-style-type: none"> Aqua Aerobic Aqua Aerobic Veolia

Removal of Phosphorus

Forms of Phosphorus

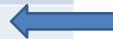
- Phosphorus (P) occurs mostly as Phosphates (PO_4).
- These are classified as *Orthophosphates* (reactive phosphates), *Condensed Phosphates* (pyro, meta, and polyphosphates) and *Organic Phosphates*.



Phosphorus Fraction

Total Phosphate (dissolved + solids)
Ortho-P Reactive (dissolved + solids)
Dissolved Total Phosphate
Dissolved Ortho-P Reactive

To achieve < 0.1 mg/L P in effluent, dissolved (soluble) reactive P should be converted into solid before filtration



Fuzzy Filter Pilot Unit

- Automated pilot trailer equipped with 18"x18" filter
- Flat topography is required
- Should be within 50' of influent source and effluent drop point
- Requires 480/3/60 electrical supply at 40 Amps
- Influent flow 70 gpm at 8 psig max pressure



Pilot Accessories & Instruments

- Flex piping with quick disconnect couplings
- Submersible pump
- Power cord for 480/3/60 supply
- Turbidity meters
- Data logging system
- Magnetic flow meter
- Pressure sensor
- PLC with touch screen



Pilot Fuzzy Filter Rental Agreement

- Schreiber Technician – 3 to 5 days for set-up, start-up, operation & training
- Submit Test Report including data, graphs and operation & performance summary
- \$5,000 plus Transportation Expense for 2 Week Test Program

Fuzzy Filter Installations

Northeast Water Reclamation Facility



- Customer: Clayton County
- Location: Georgia
- Operational: Fall 2001
- Number: 9 filters
- Size: 7 ft x 7 ft
- Capacity: 25 MGD
- Application: Tertiary

- Effluent phosphorus limit of 0.17 mg/L
- Coagulation and flocculation tank upstream of Fuzzy Filters



Fuzzy Filter Installations

Lakes Area Sewer Authority WWTP



- Customer: Cass County
 - Location: Michigan
 - Operational: Fall 2010
 - Number: 2 filters
 - Size: 3 ft x 3 ft
 - Capacity: 0.25 MGD
 - Application: Tertiary
- Effluent phosphorus limit of 0.2 mg/L
 - Co-precipitation followed by Fuzzy Filter



Fuzzy Filter Installations

Upper Montgomery Joint Authority WWTP



- Customer: Montgomery
- Location: Pennsylvania
- Construction: 2017
- Number: 4 filters
- Size: 7 ft x 7 ft
- Capacity: 9 MGD
- Application: Tertiary

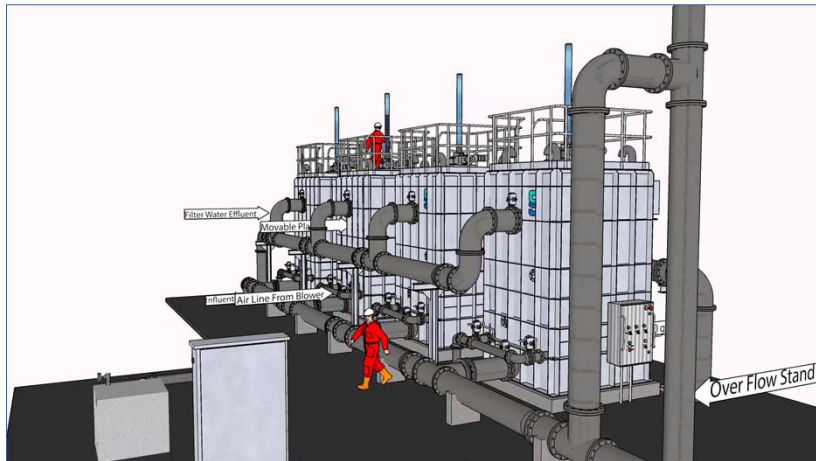
- Effluent phosphorus limit of 0.1 mg/L
- Coagulation and flocculation tank upstream of Fuzzy Filters



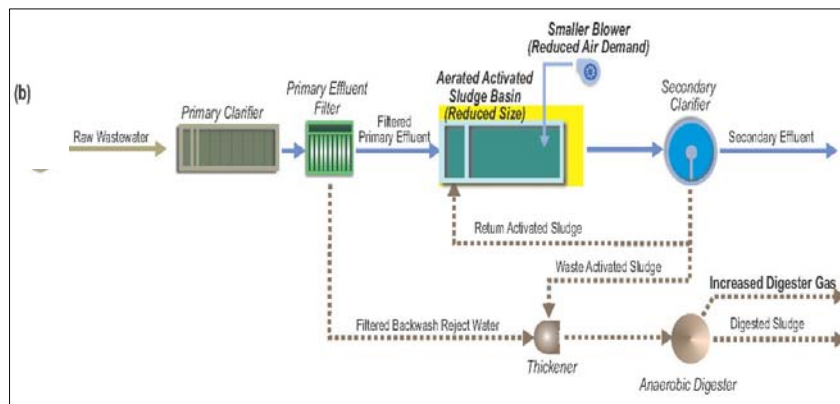
Fuzzy Filter Modular Design



Fuzzy Filter Modular Design



Primary Effluent Filtration (PEF) using Fuzzy Filter for Carbon Diversion



Pilot-Scale Demonstration Project

- Two year PEF demonstration project at Linda WWTP in California evaluating 5 filtration technologies



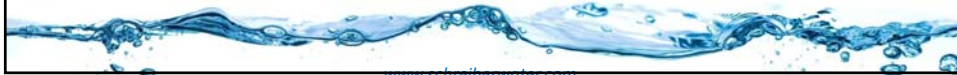
Advantages of PEF for Carbon Diversion

- Increases digester gas flow by 35 to 40%
- Reduces blower power requirement by 20 to 25%
- Increases secondary process capacity by 30 to 35%



Benefits of Fuzzy Filter

- High rate filtration up to 40 gpm/SF
- Small footprint - Use of existing structures
- Low backwash reject water
- Easy maintenance
- Reliable tertiary treatment - Effluent P < 0.1 mg/L
- PEF for carbon diversion



Thank you for your time!

QUESTIONS?

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