RENEWABLE NUTRIENTS

QUICK WASH®

Phosphorus Extraction & Recovery

QUICK WASH®

Benefits

- Removes and recovers more than 95% of phosphorus
- Reduce phosphorus recycle load
- Reduce polymer & metal salts
- Reduce disposal costs
- Eliminate struvite scaling
- Increase revenue
- Meet EPA nutrient TMDL requirements

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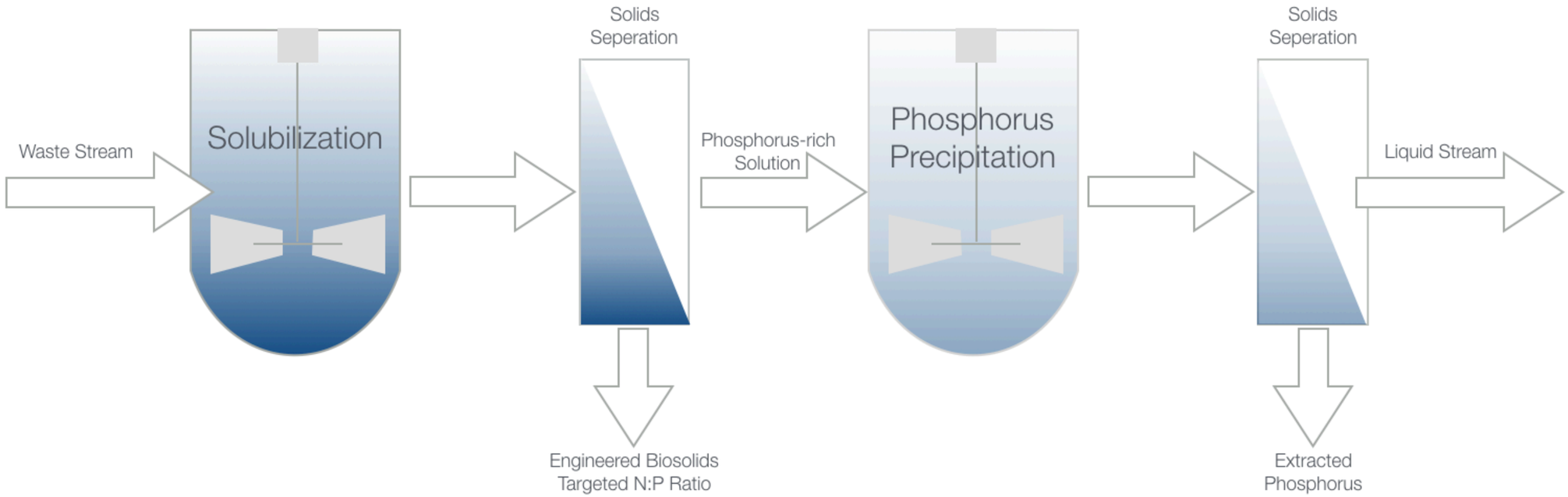
Process Flow



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Configurations/Applications

- Side Stream from dewatering (aerobic or anaerobic)
- Solids Prior to dewatering
- Prior to thickening & anaerobic digestion
- Pre-treat a high P industrial discharge
- Animal agriculture applications
- Other custom configurations

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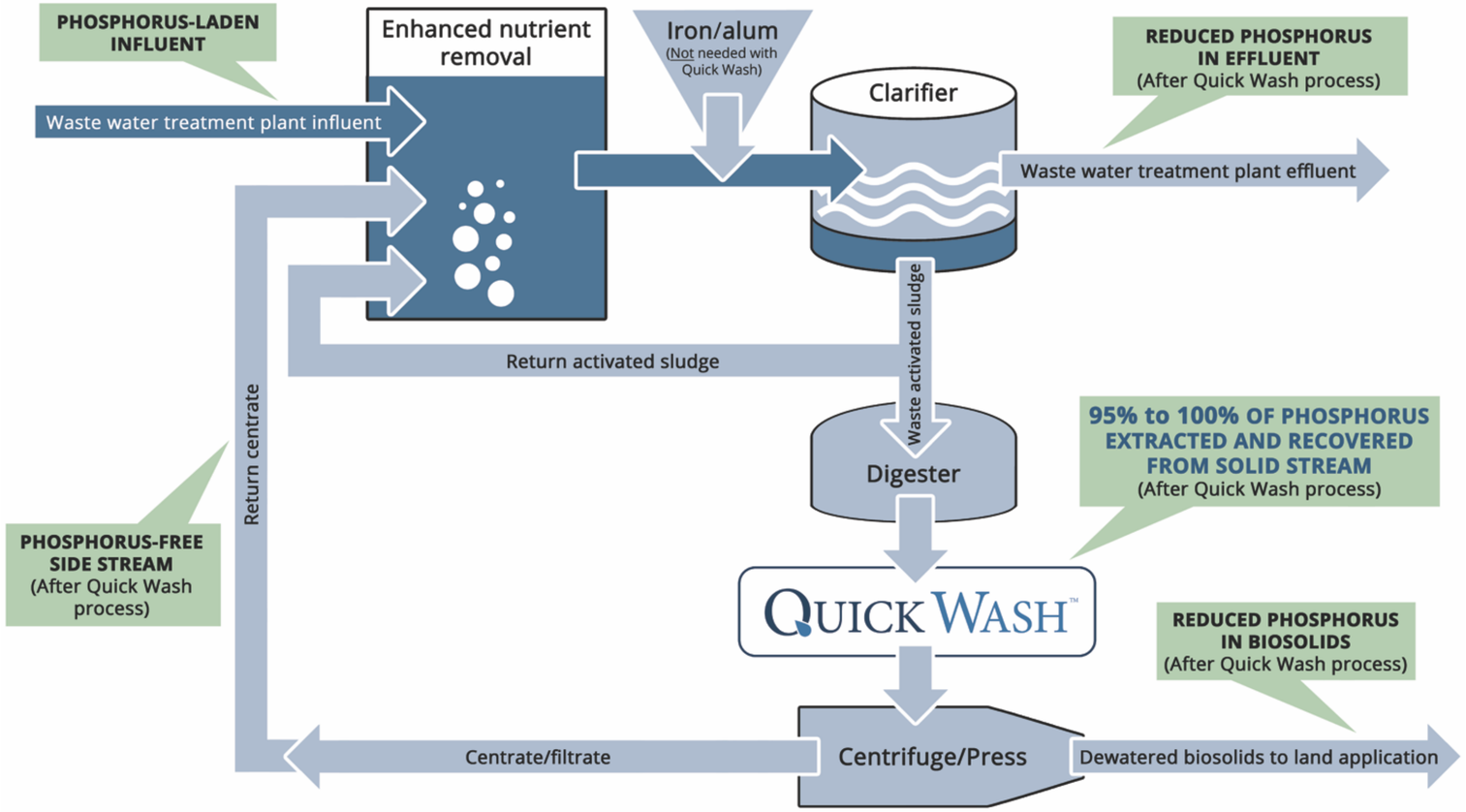
Solids Stream Extraction & Recovery



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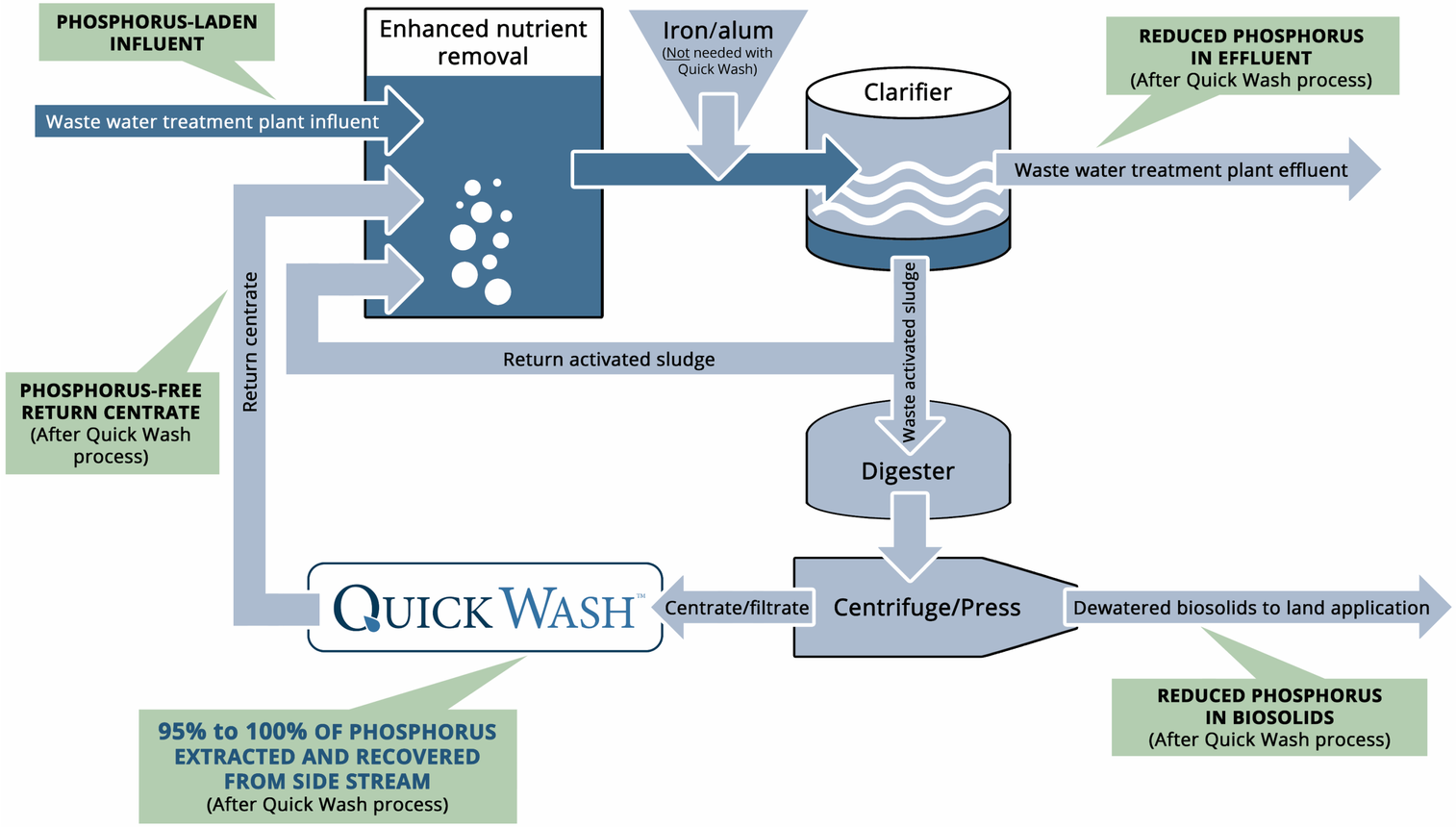
Side Stream Extraction & Recovery



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Municipal Pilot/Trial Locations

Facility	Size	Treatment
Ephrata, PA	2 MGD	Solid Stream - Feed to BFP
Westminster, MD	5 MGD	Solid Stream - Feed to Dewatering
Raleigh, NC	60 MGD	Side Stream - Filtrate from BFP
Greenville, NC	14 MGD	Side Stream Filtrate from BFP & Solid Stream - Feed to BFP
Chapel Hill, NC	8 MGD	Side Stream - Filtrate from Rotary Press & Solid Stream - Feed to Rotary Press

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Municipal Performance

BFP Filtrate 4-24-15	Total Ortho P (PPM)	Total Ortho P (Soluble)	P Extraction %	P Recovery %
Raw Filtrate Feed	164.2	Sidestream of 60MGD WWTP		
Filtrate Sep 1 Liquid	161		98%	
Filtrate Sep 2 Solids	161			
Filtrate Sep 2 Liquid		0		>99%

Feed to BFP 5-21-15	Total Ortho P (PPM)	Total Ortho P (Soluble)	P Extraction %	P Recovery %
Raw Feed to BFP	172	Solids Stream of 12MGD WWTP		
BFP Feed Sep 1 Liquid	172		>99%	
BFP Feed Sep 2 Solids	172			
BFP Feed Sep 2 Liquid		1.2		>99%

Rotary Press Filtrate 7-14–15	Total Ortho P (PPM)	Total Ortho P (Soluble)	P Extraction %	P Recovery %
Raw Filtrate Feed	498	Sidestream of 14MGD WWTP		
Filtrate Sep 1 Liquid	469.5		94.3%	
Filtrate Sep 2 Solids	469.5			
Filtrate Sep 2 Liquid		0		>99%

Select On-Board & 3rd Party Analytical Results
Quick Wash Pilot Operations

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Agricultural Performance

Facility	P Extraction %	P Recovery %	Stream Characteristics	Situation
Walk Stock Farm, IL Fall 2015	89%	>99%	Raw swine manure in sow and finisher pits	Desire to expand and operation, but limited by land availability to apply manure due to P restrictions
Fertilizer Manufacturer, PA Aug 2016	56%	>99%	Dewatered poultry litter	Recover P to mix into custom liquid fertilizer blends for specific markets
National Swine Producer, NC Sep 2016	81%	>99%	Raw swine manure in lagoon	Beneficial reuse of P for applications beyond fertilizer

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Calcium Phosphate

- Over 99% of P2O5 in recovered calcium phosphate is plant available
- Amorphous calcium phosphate (ACP) more soluble than crystalline calcium phosphates (e.g. – Hydroxylapatite)
- Recovered Calcium Phosphate vs P Fertilizer

  SSP 16% - 22% P205
  TSP 44% - 53% P205
  Calcium Phosphate 26.2% P205

- Plant Availability of P

  SSP 97% - 100%
  TSP 97% - 100%
  Calcium Phosphate 99.88% plant available P

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