Neshaminy Water Treatment Plant Design and Construction

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Acknowledgements

Aqua PA	Marc Lucca – VP Production Dave Hughes – Manager of Construction Curt Steffy – Operations Manager Tom Walton – Neshaminy WTP Superintendent Jeff Bickel – Neshaminy WTP Asst. Superintendent
Hatch Mott MacDonald	John Civardi – Lead Process Engineer Mike Polito – Project Engineer Margie Gray – Process Designer Joe Procopio – Resident Engineer Chris Evans – Design Engineer
Michael F. Ronca	David Ronca – President Phil Ruggiero – Construction Superintendent

Presentation Outline

- Background on Aqua PA and the Neshaminy WTP
- Project components and phasing
- Project Design
- Water Quality Issues and Concerns
- Project Construction
- Project Challenges
- Summary

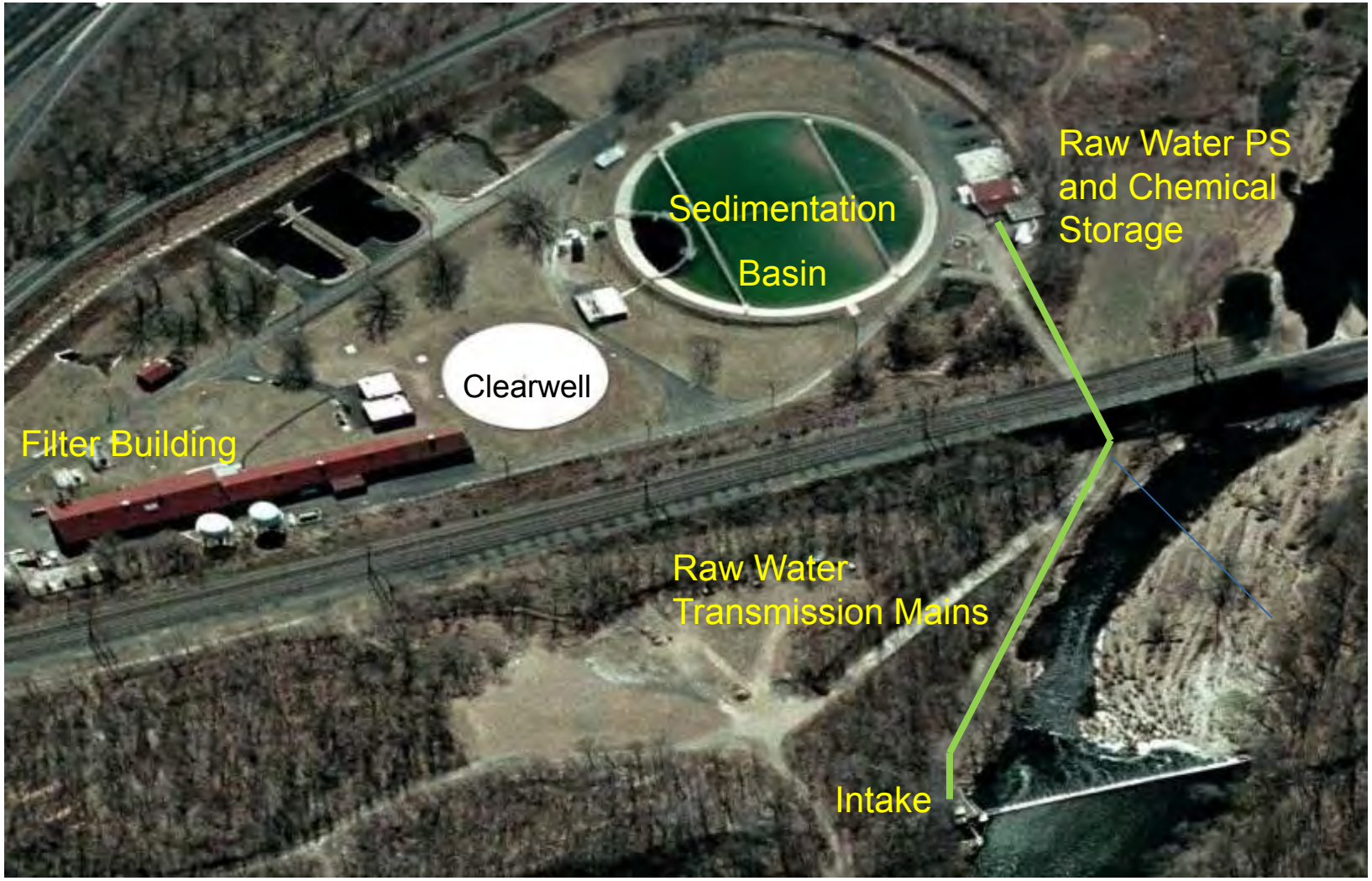
Overview of Aqua PA

- Subsidiary of Aqua America
  - Publically traded (NYSE: WTR)
  - Operations in 14-states serving 3-million people.
- Aqua PA – SE Operations
  - Serves 350,000 customers in portions of the 5 counties surrounding the City of Philadelphia
  - 8 Surface WTPs and 70 Wells
  - Total Delivered Water: 100-140 MGD

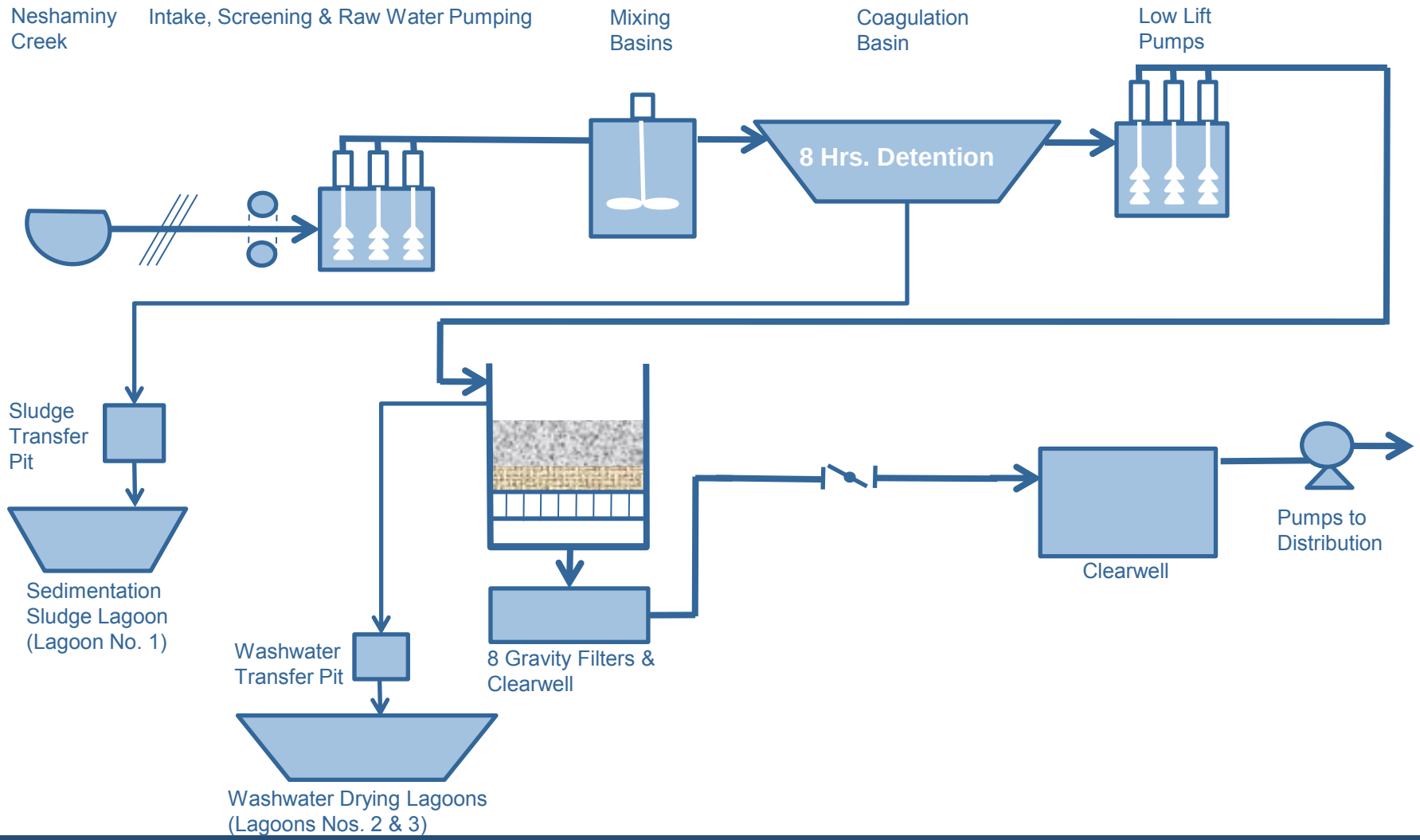
Neshaminy Water Treatment Plant

- Located in Middletown Twp., Bucks County
- Source is the Neshaminy Creek
- 15 MGD Conventional WTP consisting of raw water pumping, coagulation/sedimentation, gravity filtration, chemical storage and feed systems, and high lift pumping

Neshaminy Water Treatment Plant



Existing Schematic



Project Needs

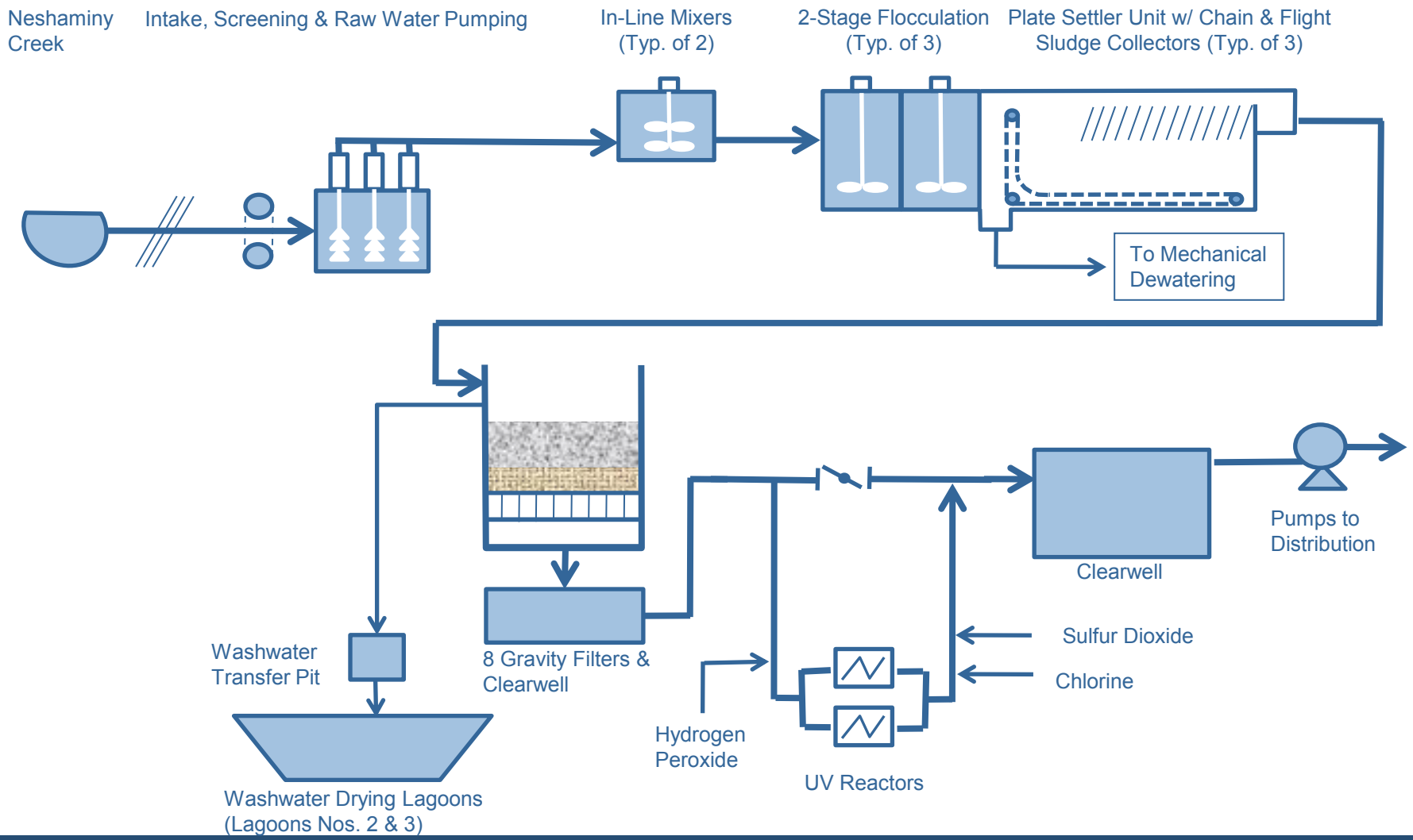
- Insufficient firm intake piping capacity
- Aging clarification system that has reached the end of its useful life and is labor intensive to clean
- Raw water pumping and screening systems that are inefficient and in need of replacement
- Aging chemical storage and feed systems
- Intermittent Taste & Odor problems
- Inefficient and labor intensive Residuals Disposal Systems

Project Components & Phasing

Phase	Facility Components	Construction Timing
Phase 1	Raw Water Transmission Main Rehabilitation	Jan 2009 – April 2009
Phase 2	Taste & Odor Treatment Facility and Office Renovations	Jan 2010 – July 2010 (Equipment pre-purchased in 2009)
Phase 3a	Raw Water PS, Pretreatment and Chemical Storage/Feed Facilities	Jan 2011 – Sep 2012
Phase 3b	Mechanical Dewatering Facilities	Oct 2012 – Dec 2013

Upgraded Neshaminy Water Treatment Plant

Upgraded System Process Schematic



Raw Water Transmission Main Improvements

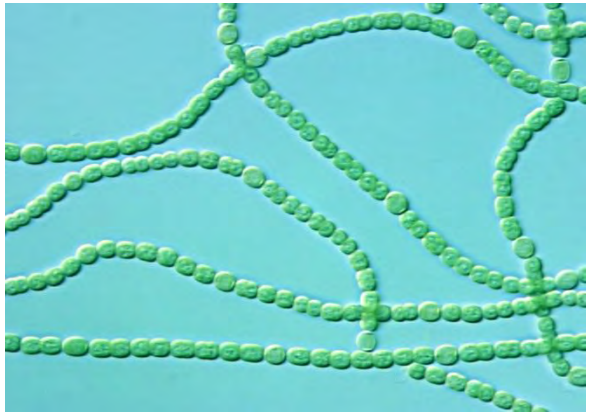
- 24” CI pipe constructed in 1908 (C = 83)
- 24” steel pipe constructed in the 1947 (C = 90)
- Combined capacity about 15 MGD
- Need firm capacity > 12 MGD

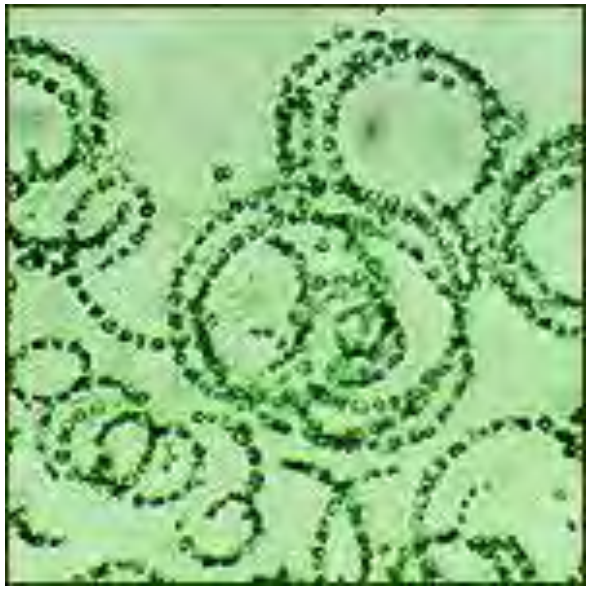
Raw Water Transmission Main Rehabilitation

- Decision made to clean and cement line both mains to increase capacity
- Each main removed from service and individually cleaned and lined (no bypass piping required)
- Subsequent hydraulic testing showed increased C values to greater than 110 and individual line capacity greater than 12 MGD

Neshaminy Creek Taste and Odor Issues

- T&O occurs seasonally generally between May and September with episodes ranging from a few days to several weeks.
- Taste and odors consist primarily of the odor-causing compounds, 2-methylisoborneol (MIB) and Geosmin.





T&O at Neshaminy from 2006 – 2008

	Geosmin	MIB
Maximum	240	45
90th Percentile	37	8
95th Percentile	55	11
Typical Threshold Value	10	4
All values in ng/l		

Cost Comparison AOP vs PAC

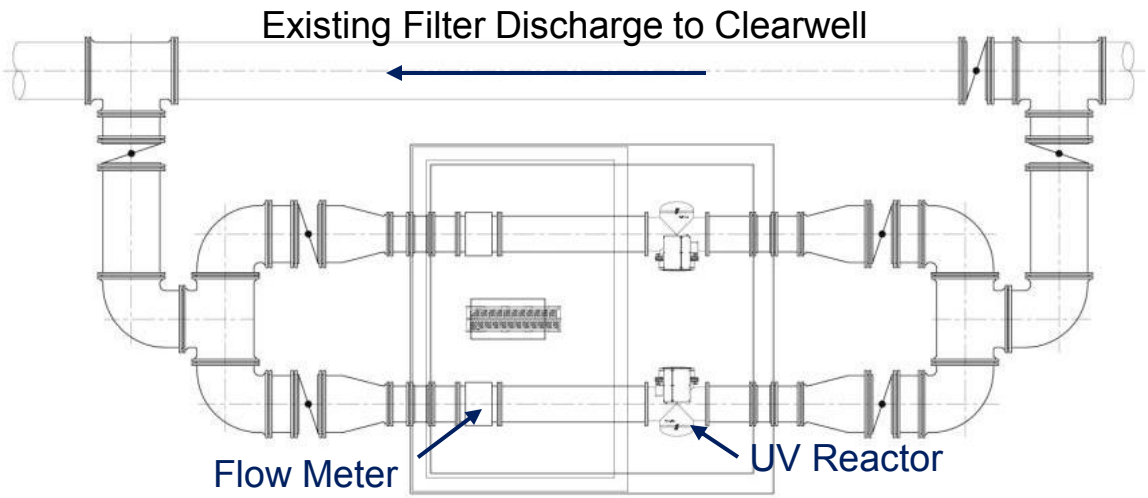
Cost	UV-H_2O_2	PAC
Capital	$2.5 million	$2.2 million
O & M	$200,000	$310,000
Equivalent Uniform Annual Cost	$384,000	$475,000

Comparison of UV-H_2O_2 and PAC

	UV-H_2O_2	PAC
Treatment Efficiency	Ability to provide 1-log removal	Only 0.5-log removal practical
Residuals	No residuals	Doubles existing sludge production at the plant
Facility Sizing	Small footprint	Large tankage
Operations	Easy to operate/adjust	More difficult to operate
Value Added	Additional Microbial disinfection	
Carbon Footprint Analysis	25% less carbon footprint over PAC	

Application of UV-Peroxide

- UV System installed post-filtration and before the clearwell where UVT is highest.
- UV-peroxide for T&O requires approx. 4 times the UV dose required for disinfection
- Actual system use has shown good T & O removals with no statistical impact on increase of TTHM's



UV Building /Reactor and H_2O_2 Storage

(From upper left, clockwise)

UV Treatment Building, Hydrogen Peroxide Storage and UV Reactor

Neshaminy Raw Water Quality (2009)

Parameter	Average	Maximum
Turbidity (NTU)	14	830
Raw Water TOC	3.6	8.0
Filtered Water TOC	2.0	2.8

Pretreatment

- Tapered two stage flocculation
- Plate settlers designed at 0.3 gpm/sf at 80% plate efficiency
- 3 trains @ 6 MGD each
- 46 minutes detention time at 15 MGD
- Automatic solids removal removal

Pretreatment Building

Pretreatment Building

Raw Water Pump Station

- Integrated into new Pretreatment Facility
- Two Traveling Screens
- 3 Raw Water Pumps
  - 2 @ 7.5 MGD w/VFDs
  - 1 @ 6 MGD Constant Speed
- Redundant In-Line Mechanical Mixers and Flow Meters
- Chemical Addition for:
  - Lime
  - Chlorine
  - Sulfuric Acid
  - PAC
  - Alum

Chemical Systems

Alum Day Tank

Chlorine Ton Cylinder Storage

High Density Lime System

Sulfuric Acid and Cl_2 Scrubber

Water Quality Comparison

Parameter	Old Basin	New Pretreatment
Settled Turbidity (NTU)	0.62	0.54
Raw Water TOC	3.6	3.6
Settled Water TOC	2.3	2.3
Settled Water TTHMs	38	29
All values are average		

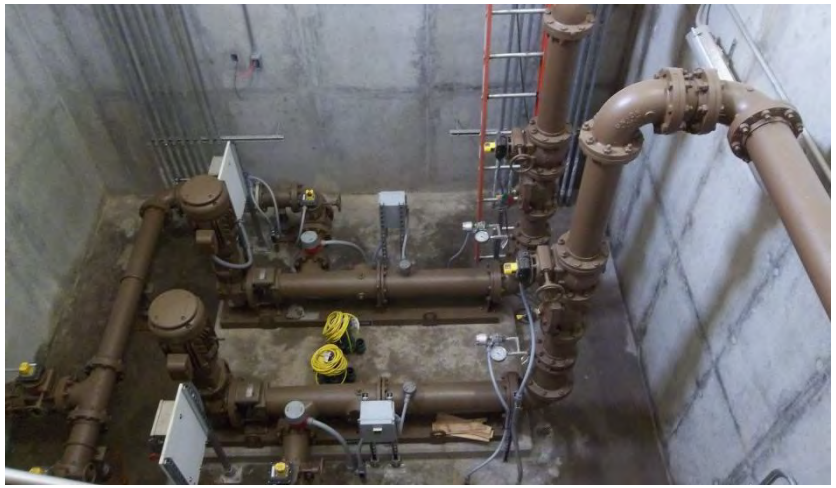
Residuals Treatment Facility

- Two 30 ft. diameter gravity thickeners
- Two TSMEBs
- Two 2 meter belt presses
- 2,750 lbs DS/day (Avg) 6,800 lbs DS/day (max mo.) and 12,000 lbs DS/day (max week)
- Cake residuals trucked to nearby quarry landfill

Residuals Treatment Facility

Thickeners

Residuals Building



Sludge Pumps

Sludge Conveyor and Belt Press

Project Challenges

- Transition of old/new process
  - Operators somewhat familiar with the new process technology
  - Chemical feed systems not completed and needed to use existing systems
  - Old/New processes run together initially
- What to do with the residuals from the new process until the new RTF is complete?
- High pressure (450 psi) transmission main installation on-site during construction

Cost Summary

Phase	Facility Components	Total Project Cost
Phase 1	Raw Water Transmission Main Rehabilitation	$0.3 million
Phase 2	Taste & Odor Treatment Facility and Office Renovations	$2.5 million
Phase 3a and 3b	Raw Water PS, Pretreatment and Chemical Storage/Feed Facilities and Mechanical Dewatering Facilities	$22.2 million
	Total	$25 million

Summary

- Improved hydraulic capacity of the raw water conveyance system
- Improved pumping operations and efficiency
- High quality pretreatment system
- Improved T & O treatment system
- More efficient/Less Labor Intensive Residuals Treatment System

Thank You
and
Questions?

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