



Riviera
Utilities

AQUANEREDA

Aerobic Granular Sludge

A Operator's Perspective -- Riviera Utilities -- WWTF -- Foley, AL



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Why Innovate?

"Twenty years from now you will be more disappointed by the things you didn't do than by the ones you did. So throw off the bowlines, sail away from the safe harbor, catch the trade winds in your sails. Explore. Dream. Discover."

~ Mark Twain

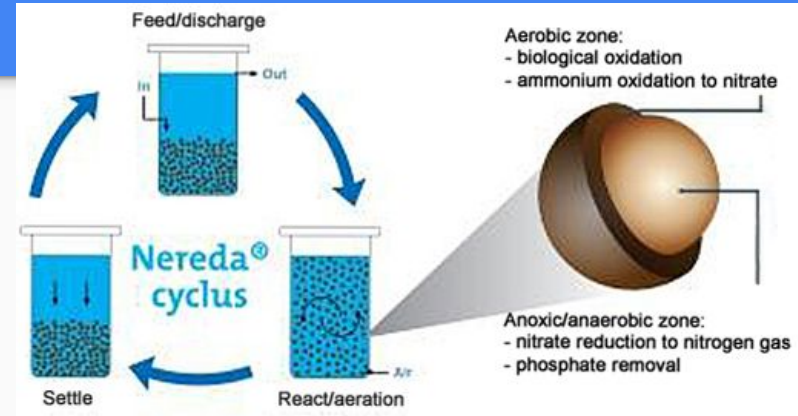
AquaNereda Checks all the Boxes

-- Aerated Granular Sludge



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- Requires less Dissolved Oxygen
- Removes Nitrogen and Phosphorus
- Stays in the tank during peaking rain events
- Robust to shock loads
- Rapid Settling maximizes plant treatment capacity
- Process is not susceptible to Filamentous Bacteria
- Alginate can be beneficially reused in the future

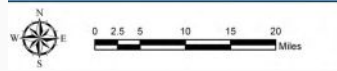


Should we be “safe” and stick with 100 year old technology?



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-- Spend Your Money Wisely or Spend it 2 Times !!!!



Map ID: Maps_Perdido.mxd
 Map Created: 07/13/2012
 Created by: Jonathan Turner, DEP

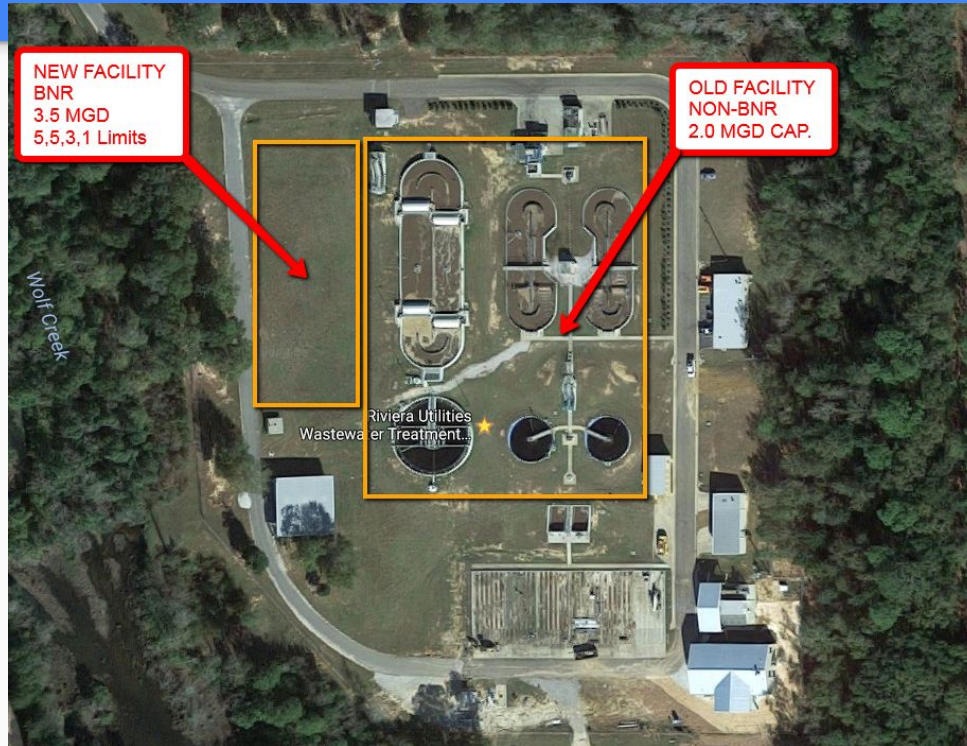
TP (mg/L)								
Annual Geometric Mean Limit Approach					Single Sample Value Approach			
Segment	Historic Geometric Mean	Number of Calculated Annual Geometric Means	Standard Deviation (Ln TP)	Maximum Annual Geometric Mean (1 of 3-year exceedance rate)	Geometric Mean	Standard Deviation (Ln TP)	Number of total samples	Single Sample Limit not to be exceeded in >10% of samples
Lower Perdido Bay	0.0319	2	0.2602	0.0494	0.0356	0.8598	29	0.110
TN (mg/L)								
Lower Perdido Bay	0.377	3	0.3774	0.808	0.474	0.4474	29	0.779

Should we be “safe” and stick with 100 year old technology?



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-- *LARGE AND NUMEROUS TANKS Limit Future Expansion*



Should we be “safe” and stick with 100 year old technology?

-- *Maintenance*



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Should we be “safe” and stick with 100 year old technology?



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-- Shallow Inefficient Aeration Technology

General Oxygen Transfer Efficiency
(standard conditions)

kg/kwh	lb/hp-h	
	11	
6	10	High-Density / Low-Flux Aeration Systems
5	9	
	8	
4	7	Typical Fine Bubble Diffuser System
3	6	
	5	
	4	
2	3	Jet Aerators & Coarse Bubble Diffuser Systems
	2	Mechanical Floating Aerators
1	1	Aspirating Floating Aerators



Should we be “safe” and stick with 100 year old technology?

-- Nocardia Foam Trapped in Ditch



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Should we be “safe” and stick with 100 year old technology?

-- *RAS Pumping*



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Should we be “safe” and stick with 100 year old technology?

-- Chemical Nutrient Removal



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Why AQUANEREDA?

Technology that has been proven in the laboratory and in the hands of operators across the planet. Science that is sustainable.









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Advanced Treatment without Complexity

Advanced Biological Nutrient Removal in 3 steps with 3 tanks!

The power is in the ***Aerated Granular Sludge*** in a single tanks -- **NOT:**

Anaerobic Tanks, Anoxic Tanks, Aerobic Tanks, Baffles, Mixers, Clarifiers, Chemicals, Ballast, Ballast Recovery/Addition, Plastic Carriers, Strainers, Membranes, Supplemental Carbon Sources, Fermenters, RAS PUMPS, Recirculation PUMPS, ETC.

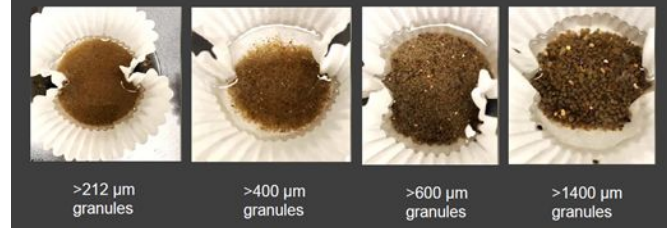
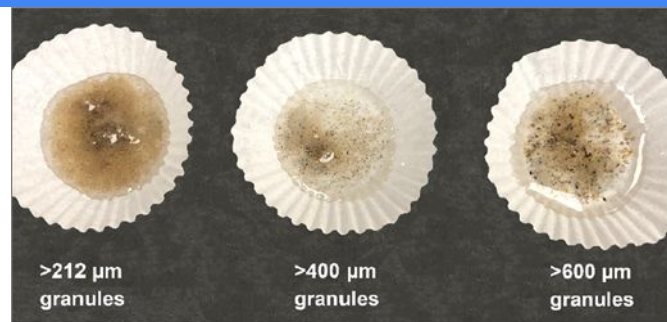
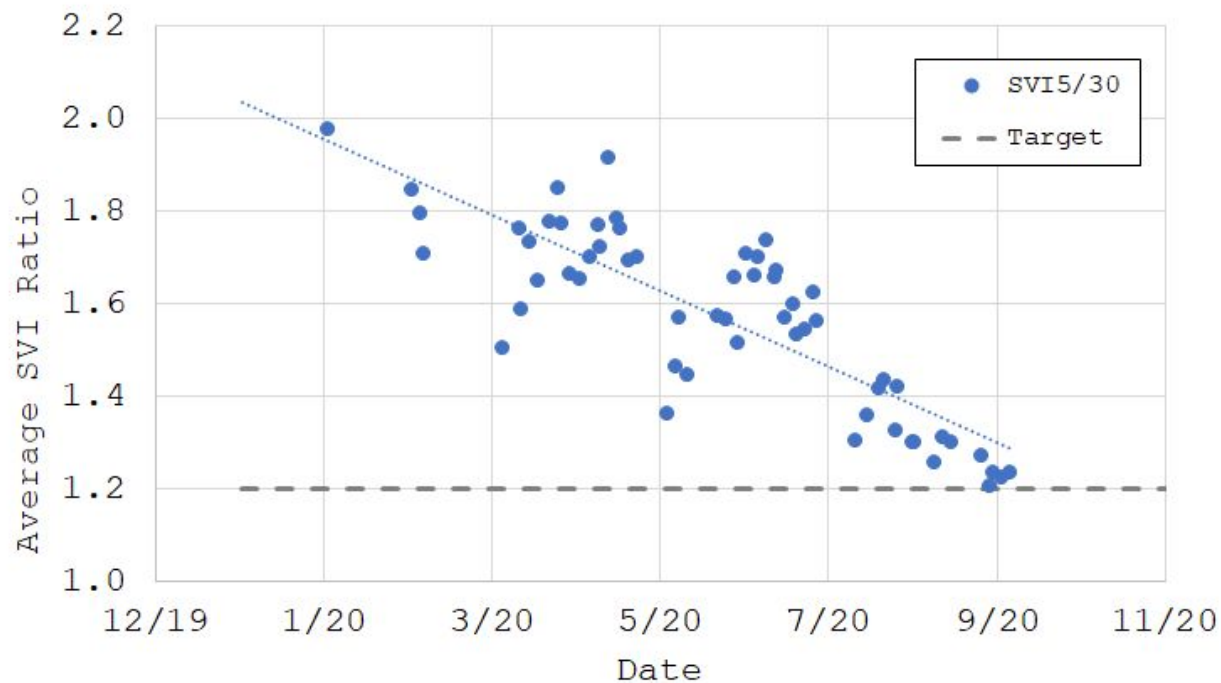


AquaNereda Checks all the Boxes

- Capacity Improvement in a small area reserving space for the future.
- Enhance Water Quality of Alabama Outstanding Waterway -- Wolf Bay
- Lowest Capital Investment & Operating and Maintenance Cost per Gallon
- Ease of Operation with Minimal Labor.
- Enhanced Sludge Settleability without Ballasts or Additives
- Remote Process Monitoring using SCADA System
- World Class Equipment, Service and Support from Aqua-Aerobic Systems
- World Class Process Research from Royal HaskoningDHV and TU Delft

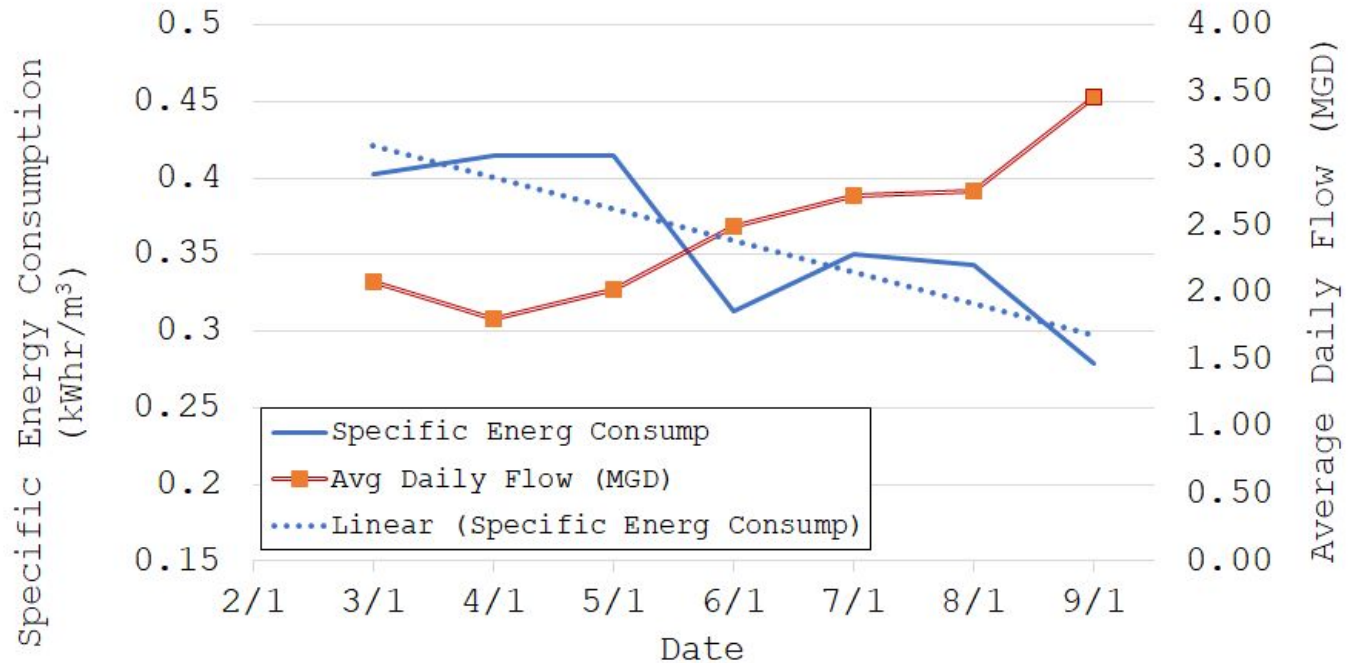
Granulation

Sludge Volume Index





Specific Energy Consumption



Storm Resiliency



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Storm Resiliency



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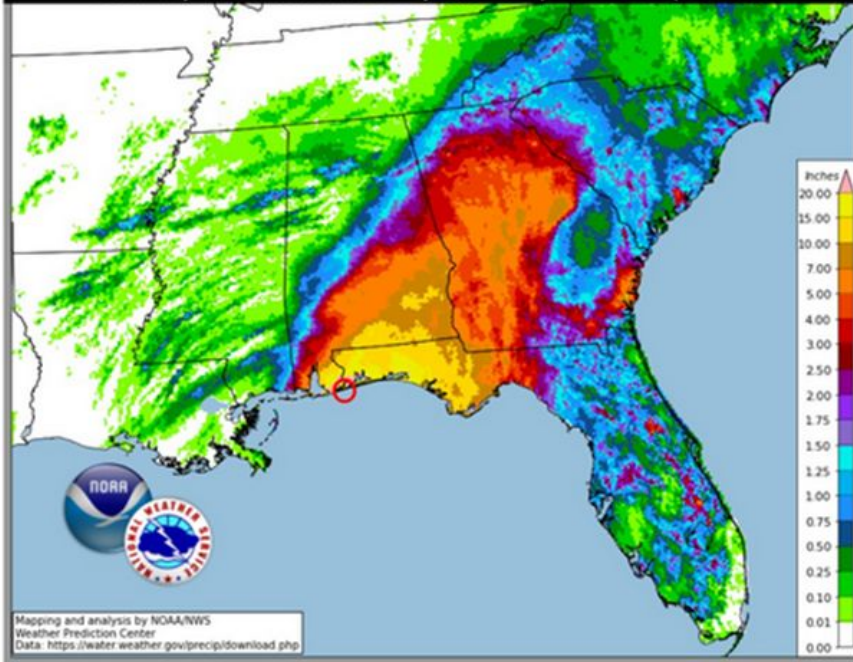


WEATHER PREDICTION CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



Hurricane Sally Preliminary Rainfall Totals through 8 am EDT, Thursday, September 17, 2020

Preliminary 72-hour Total Rainfall Analysis, 8 AM Sep. 14 - 8 AM Sep. 17, 2020



Select higher rainfall totals from Alabama and Florida*

Location	Amount	Time/Date
...Alabama...		
Orange Beach	29.99 in	0616 AM 09/17
Gasque	18.68 in	0653 AM 09/16
Pollard 2.4 N	18.48 in	0800 AM 09/17
Summerdale 2.7 NW	15.79 in	0800 AM 09/17
Breuxton	14.27 in	0100 AM 09/17
Red Level 0.3 SW	13.36 in	0800 AM 09/17
Loxley 3.5 SSE	13.24 in	0800 AM 09/17
Falco 5.3 NE	12.66 in	0246 PM 09/16
Silverhill 2.8 W	12.08 in	0445 PM 09/16
Dixon	12.06 in	0718 PM 09/16
Daphne 4.9 SE	11.96 in	0800 AM 09/17
Point Clear 0.6 SW	11.83 in	0800 AM 09/17
Fairhope 1.5 WSW	11.55 in	0700 AM 09/17
Montrose 1.9 SE	11.40 in	0315 PM 09/16
Geneva	11.25 in	0800 AM 09/17
Spanish Fort 2.2 SW	10.50 in	0915 AM 09/17
Enterprise 3.8 ESE	10.23 in	0800 AM 09/17
Baker Hill 3.9 SW	8.76 in	0618 AM 09/17
Bessemer	7.88 in	0113 PM 09/16
Montgomery 12.9 S	5.73 in	0600 AM 09/17
Dothan	5.29 in	0853 AM 09/17
...Florida...		
Pensacola	24.80 in	0724 AM 09/16
Santa Rosa Beach	17.65 in	0857 AM 09/17
Freeport 3.4 S	17.24 in	0800 AM 09/17
Panama City Beach 0.3 SW	16.72 in	0800 AM 09/17
Miramar Beach 9.5 ESE	16.56 in	0800 AM 09/17
Vernon 10.6 WSW	15.93 in	0800 AM 09/17
De Funiak Springs 4.1 NW	15.60 in	0800 AM 09/17
Crestview	15.34 in	0735 PM 09/16
Havarre 2.1 NW	14.98 in	0800 AM 09/17
Niceville 3.6 SE	14.77 in	0800 AM 09/17
Ft Walton Beach	13.70 in	0628 AM 09/17

*Courtesy of CoCoRaHS & Public Information Statements & Local Storm Reports from NWS Mobile, Birmingham, & Tallahassee

AquaNereda Checks all the Boxes

-- *Process Configuration*



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- Stable Head Conditions for blowers due to fixed decanters.
- Covered Weirs eliminate constant algae accumulation and cleaning
- Process has integrated sludge thickening to save digester space
- 3 Tank configuration eliminate input and output buffer tanks.
- Instrumentation creates repeatable process
- Wastewater feed tubes can be cleaned without draining tanks
- Multiple tanks facilitate diffused aeration maintenance



AquaNereda Checks all the Boxes

-- Why invest in SBR AquaNereda Process?

- 1) Lowest Total Cost of Operation and Maintenance**
- 2) Lowest Total Investment**
- 3) Three step biological nutrient removal process to protect Wolf Creek/Bay.**
- 4) Operator friendly and future proof process.**
- 5) Robust process that is resistant to shock loading from unauthorized discharges.**
- 6) Lowest possible footprint making expanding capacity to well over 10 MGD permit possible.**