



New Technologies Reduce Sludge Handling at Northern Moraine Utility Commission

Wisconsin Wastewater Operators' Association

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Existing Wastewater Facility

- ❖ Constructed in 1976
- ❖ Multiple Remote Influent Lift Stations
- ❖ Mechanical Screen
- ❖ Two Package Activated Sludge Plants
- ❖ Seepage Cell Discharge

Existing Wastewater Facility BioSolids Handling

- ❖ Aerobic Digestion
- ❖ No Separate Biosolids Storage
- ❖ Staff Liquid Haul Biosolids in Summer
- ❖ Contract Haul Liquid Biosolids in Winter

Existing WWTP Capacity

❖ Average Daily Flow	0.560 mgd
❖ BOD Load	561 lbs/day
❖ TSS Load	660 lbs/day

2008 WWTP Flows and Loads

❖ Average Daily Flow	0.345 mgd
❖ BOD Load	721 lbs/day
❖ TSS Load	690 lbs/day

2008 Operation

❖ BOD	5 mg/l
❖ TSS	4 mg/l
❖ TKN	2 mg/l
❖ Total Nitrogen	9 mg/l

2008 Capacity Limitations

- ❖ Limited Aerobic Digestion Capacity
- ❖ Sludge Storage Not Adequate for 180 Days
- ❖ Headworks Aging and Need of Physical Replacement
- ❖ Future Loads Will Exceed Capacity of Package Plants

2008 WPDES Permit Limits

❖ BOD ₅	50 mg/l ¹
❖ TSS	N/A
❖ NO ₂ + NO ₃	14.6 ²
❖ NH ₃	2.1 ²
❖ Organic Nitrogen	2.1 ²

1 – Wastewater Effluent Limit

2 – Groundwater Limit

Future Conditions

❖ Average Daily Flow	0.403 mgd
❖ BOD Load	820 lbs/day
❖ TSS Load	806 lbs/day
❖ TKN Load	121

Alternatives for Biosolids Treatment

- ❖ Sludge Storage Tank
- ❖ Sludge Minimization with Aquarius Multi-Stage Activated Biological Process (MSABP)

MSABP Pilot Plant

- ❖ Demonstrate MSABP Ability to Remove BOD, TSS, and Total Nitrogen
- ❖ Test Under Cold Weather Conditions
- ❖ Use Data in Facilities Plan

MSABP Pilot Plant

- ❖ Pilot Plant Started Operation February, 2007
- ❖ Trial Operation Ran from March 16, 2007 to June 20, 2007

MSABP Pilot Plant Results

- ❖ Good Performance Through April
- ❖ Sewer Cleaning in May Thought to Cause Grit in Tank and Discharge
- ❖ Heavy Loads from Memorial Day Caused Septic Conditions and Treatment Upset

MSABP Pilot Plant Results

- ❖ Process Met NMUC Permit Requirements
- ❖ BOD/TSS < 10 mg/l for First 6 Weeks
- ❖ BOD/TSS > 10 mg/l for Next 6 Weeks
- ❖ Lack of Grit Removal Impacted Performance
- ❖ Lack of D.O. Control Impacted Performance

MSABP Pilot Plant Results

- ❖ Second Pilot Test Immediately After NMUC at Roselle, Ill.
- ❖ 9 Month Trial Showed Consistent Performance for NMUC Effluent Limits

Facilities Planning

- ❖ Recommended MSABP
- ❖ Added Grit Removal
- ❖ Added Salsnes Screen for Lower BOD Loading and Better Screening
- ❖ Two Phased Construction Approach to Allow Full Scale Testing

New Technology Challenges

- ❖ Presentation of Technology to WDNR
- ❖ Presentation of Technology to NMUC
- ❖ Minimize Risk to NMUC
- ❖ Operate Pilot Plant To Simulate NMUC Conditions

Minimize Risk with New Technology

- ❖ Required Equipment Supplier to be Responsible for Process Design
- ❖ Performance Warranty Based on MSABP Effluent
- ❖ Provide Additional Processes (Final Clarifier, Sludge Pumping) to Meet Unexpected Challenges

Design Features – Grit Removal

- ❖ Pilot Plant Showed Grit Removal Important
- ❖ Vortex Type Selected for Low Head Loss

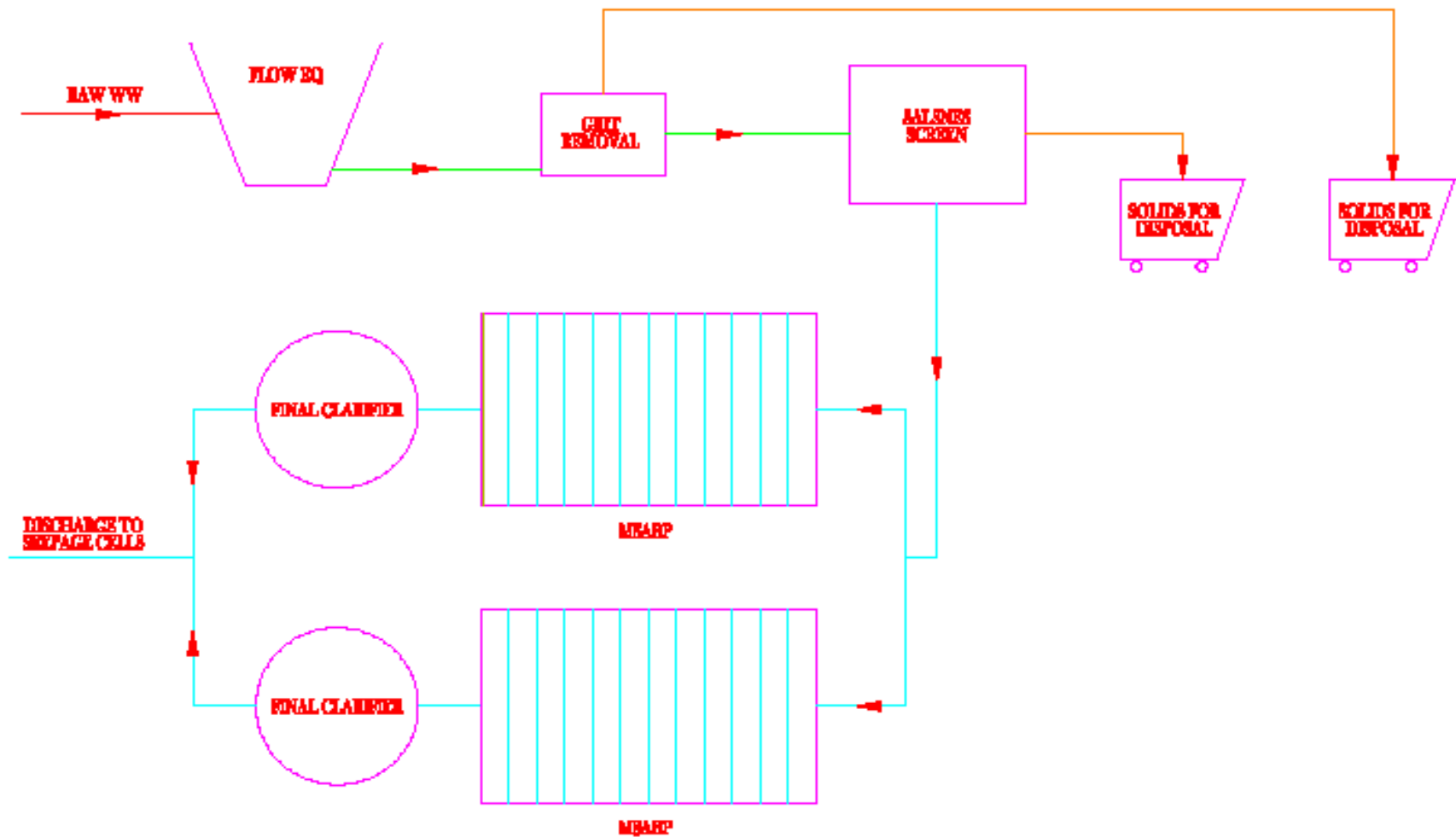
Design Features - Salsnes Screen

- ❖ Provides Excellent Screening (350 Micron)
- ❖ 25% BOD₅ Removal
- ❖ 40% TSS Removal
- ❖ Reduces BOD₅ Loading on MSABP

Design Features – MSABP

- ❖ Retained Final Clarifier For Solids Removal
- ❖ Retained Ability to Waste Sludge from Final Clarifier
- ❖ Provided Means of Solids Removal From Each Cell
- ❖ Solids Can Be Pumped to Headworks for Removal in Screening Process

NORTHERN MORAINE UTILITY COMMISSION PROCESS DIAGRAM



North Cell - 50% Flow - 5/21/10 - 9/1/10

	North Plant Cell 12	Plant Effluent
BOD ₅	5.8	6.5
TSS	10.8	3.6
NH ₃		0.3
TN		17.1

North Cell – 100% Flow – 10/4/10 – 1/19/11

	North Plant Cell 12	Plant Effluent
BOD ₅	34.3	9.9
TSS	40.9	5.9
NH ₃		1.8
TN		27.2

North and South Cells - Split Flow - 1/24/11 - 3/30/11

	North Plant Cell 12	South Plant Cell 12	Plant Effluent
BOD ₅	35.6	7.1	14.4
TSS	34.8	9.9	3.4
NH ₃			2.0
TN			26.3

North and South Cells - Split Flow - 4/1/11 - 7/23/11

	North Plant Cell 12	South Plant Cell 12	Plant Effluent
BOD ₅	92.4	83.9	13.0
TSS	141.1	111.8	6.1
NH ₃			2.0
TN			25.0

North and South Cells - Split Flow - 8/1/11 - 9/14/11

	North Plant Cell 12	South Plant Cell 12	Plant Effluent
BOD ₅	14.4	7.7	3.9
TSS	81.7	28.7	5.1
NH ₃			0.3
TN			23.8

Start-up Issues

- ❖ Gradual Start-up Improved Performance Over Rapid Start-up
- ❖ Inert Solids Causing High Effluent TSS from MSABP
- ❖ Biosolids Removal Was Required at Low Rate
- ❖ Biosolids Hauling Reached Equilibrium in August 2011

Biosolids Minimization Assessment

- ❖ Activated Sludge Typical Yield
 - ▶ 0.8 lbs VSS/lb BOD₅ Removed
- ❖ MSABP Yield at NMUC
 - ▶ 0.12 lbs VSS/lb BOD₅ Removed
- ❖ MSABP Net Biosolids Production 15% of Typical Activated Sludge

New Technology - Salsnes Screen

- ❖ 31% BOD₅ Removal
- ❖ 56% TSS Removal
- ❖ Similar Performance to Primary Clarifier
- ❖ Sensitive to Slug Loads
- ❖ Cannot Waste Biosolids to Screen

New Technology - MSABP

- ❖ Low Sludge Yield
- ❖ Needs Final Clarifier
- ❖ TN Removal May Require Internal Recycle
- ❖ Fine Tuning On-going

Summary

- ❖ Biosolids Minimization Achieved
- ❖ New Technologies Expanded Capacity Within Same Footprint
- ❖ Process Met Plant Effluent Limits
- ❖ Pilot Plant \neq Full Scale Operation
- ❖ Still Fine Tuning Operation



Flow Equalization



Grit Removal





Headworks/Salsnes Screens





Headworks/Salsnes Screens





Headworks/Salsnes Screens





Headworks/Salsnes Screens





Dewatered Screen Solids



Dewatered Grit





Screening Blower



Screening Control Panels





Cell 1 - MSABP





Cell 12 - MSABP





Cell 1/2 - MSABP





Solids Removal Piping





Sludge Wasting Cell



Solids Removal Pump



Foth