

Landfill Leachate Pretreatment Process Evaluation and Pilot Study

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Presentation Overview

- Part 1 – Overview of Study, Piloting, and Design
 - Introduction
 - Timeline of Study, Evaluation, & Disposal
 - Wastewater Characterization & Pretreatment Study
 - Timeline of Piloting and Design
 - Pretreatment Design



Presentation Overview

- Part 2 – Pilot Treatment
 - Sessil Media Trickling Filter Pilot
 - Chemical Treatment Jar Testing and Pilot Considered
 - ElectroCell Piloting
 - Next Steps



Introduction

- Rumpke Sanitary Landfill
 - Cincinnati, OH, Colerain Township, Northwest Hamilton County
 - Rumpke Consolidated Companies, Inc.
 - Family Owned, Operated since 1945
 - One of the largest landfills in the nation, largest in Ohio





Rumpke Colerain Township Landfill

Introduction

- Northwest Area Landfill
 - Portion of landfill undergoing a reaction since August, 2009
 - Source of extremely strong leachate
 - Averaging 120-degrees Fahrenheit
 - Average Volumes of 120,000 GPD (2010-2011) to 200,000 GPD (2012)



Northwest
Lift Station



Lift Station
No. 2

Pilot and
Tanker
Loadout
Locations

Northwest Area Landfill

Introduction – NW Area

Leachate

Current Characteristics	
COD	30,000 to 50,000 mg/L
BOD ₅	20,000 to 30,000 mg/L
TSS	1,000 – 2,000 mg/L
TKN	1,500 – 2,500 mg/L
Fe	250 – 700 mg/L
Ca	1,500 – 3,700 mg/L
Temperature	120 degrees F

Introduction – NW Area Leachate

- On –Going Issues
 - Pipe scaling/clogging during conveyance
 - Odors during handling/disposal
 - Costs for disposal



Study, Evaluation, and Disposal Timeline

- August, 2009 – Increasing leachate strength from Northwest Area
- August, 2010 to May, 2011 – Wastewater Characterization & Pretreatment Study
- August, 2011 to June, 2012 – Treatment Piloting and Pretreatment Design

Study, Evaluation, and Disposal Timeline - Continued

- Historically until October 7, 2011 –
“Blended” Flow Sewer Discharge into
MSDGC Collection System
 - NW Area Leachate (Approx. 70% of Total Discharge)
 - Other Site Landfill Leachate
 - Truck Wash Discharge
 - Building Sanitary Sewer Laterals
 - Other Site Sources

Study, Evaluation, and Disposal Timeline - Continued

- October 7, 2011 to Present – NW Area Leachate Hauled for Disposal
 - Averaged 120,000 gpd initially
 - Average increased to 200,000 gpd in 2012
 - 33 Tanker Loads per Day (7 Days/Week)

2010- 2011 Wastewater Characterization and Pretreatment Study

- Extensive Field Sampling and Analysis
- Eight Strategic Sampling Locations
- Pretreatment Study for “Blended” Discharge
- Bench Scale Aeration System Developed for Testing/Analysis



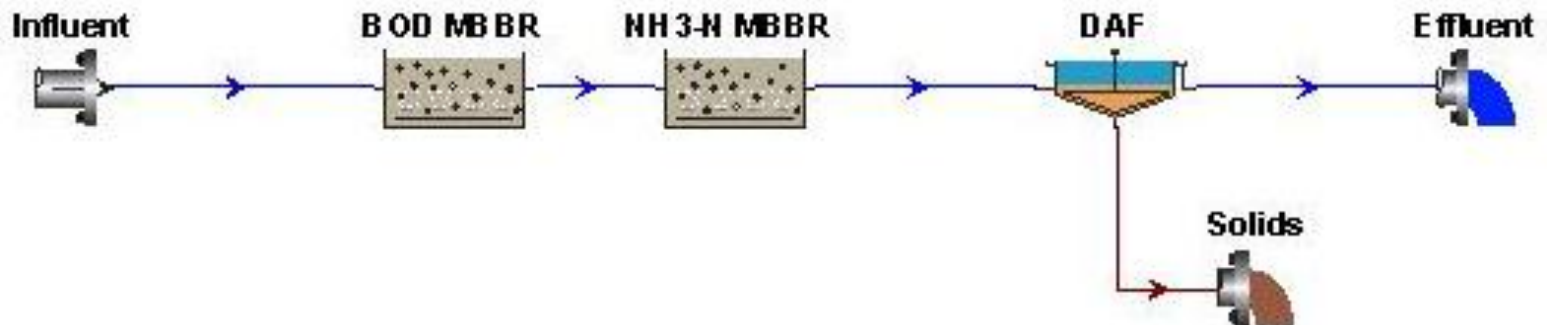
2010- 2011 Wastewater Characterization and Pretreatment Study - Continued

- Performed Respirometer Testing for Treatability
- Treatment Alternative Evaluation
- Biowin Modeling for Treatment Unit Sizing
- Recommended Alternative including Sessil Media Trickling Filter



2010- 2011 Wastewater Characterization and Pretreatment Study

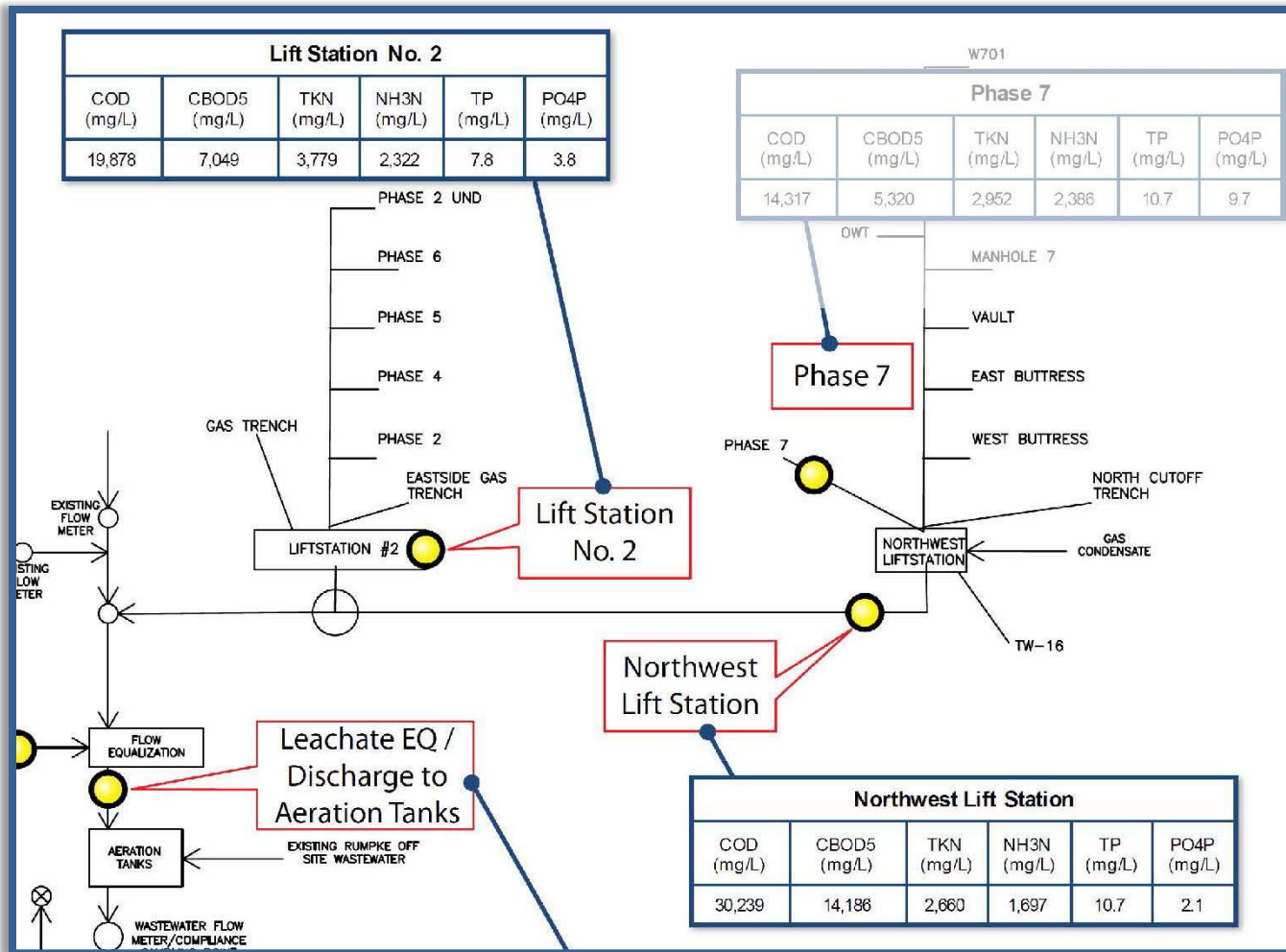
- Design Criteria for Conceptual Design
 - BOD₅ Loading of 11,300 lbs/d
 - 170,000 gpd “blended” average daily flow rate
 - Phase 1 for 70% BOD₅ removal
 - Possible Phase 2 for remaining BOD₅ and TKN



2010- 2011 Wastewater Characterization and Pretreatment Study

- Major Study Conclusions
 - Waste is biologically treatable
 - Chemical pretreatment needed for struvite or other scaling/deposition control
 - No significant inhibition and no toxicity concerns for biological treatment
 - Lift Station #2 and Northwest LS flow accounted for 70% of the flow and 95% of the surcharge load to MSDGC





**2010 Wastewater Characterization –
Northwest Area Portion of Results Figure**

Pilot and Design Phase Timeline

- August, 2011 – Start of design phase (for NW Area Leachate only)
- Sept. 27, 2011 – Initial start of Sessil Media Trickling Filter Pilot
- Oct.7, 2011 – Began hauling leachate due to odor and other sewer issues
- Oct. 13, 2011 – Draft Basis of Design Memorandum

Pilot and Design Phase Timeline

- December, 2011
 - Odor Control Basis of Design Memorandum
 - Sampling at lift stations for detailed odor analysis
- Winter, 2011
 - Chemical Treatment Jar Testing Performed
 - Detailed Design for Pretreatment Facility



Pilot and Design Phase Timeline

- Jan. 2012 – Chemical Pretreatment Basis of Design Memorandum
- Feb. 29, 2012 – Design Suspended after 65% Completion to Re-evaluate Design Criteria

Pretreatment Facility Design through February, 2012

- Design Criteria Established in October, 2011
- For Treatment of Only NW Area Leachate - Not “Blend”
- Based on 120,000 GPD Average Flow Rate
- 18,000 lb/d Influent BOD₅ Loading Rate
- Pretreatment for 70% BOD₅ Removal
- Sited at Northwest LS site to minimize conveyance issues

Pretreatment Facility Design through February, 2012 – Unit Processes

- Chemical Pretreatment
 - Rapid Mix, Flocculation, and Sedimentation Basin
 - Lime, Sodium Hydroxide, Activated Bentonite, Polymer
- Biological Treatment
 - Two 70-ft. Diameter Sessil Media Trickling Filters
 - Recirculation Pump Station for 38 to 56 Recirc. Ratio
 - Dissolved Air Flotation Solids Separation

Pretreatment Facility Design through February, 2012 - Continued

- Solids Handling
 - Mixed/Aerated Sludge Holding
 - Belt Filter Press Dewatering
 - Conveyor to Roll-Off Container for landfill disposal
- Odor Control
 - Geodesic domes on Filters
 - Pretreatment Building with Dirty Air / Clean Air Sides
 - Chemical Scrubber for Ammonia
 - Biofilters for Reduced Sulfur Compounds and VOCs
 - Carbon Adsorption as Backup / Insurance Barrier

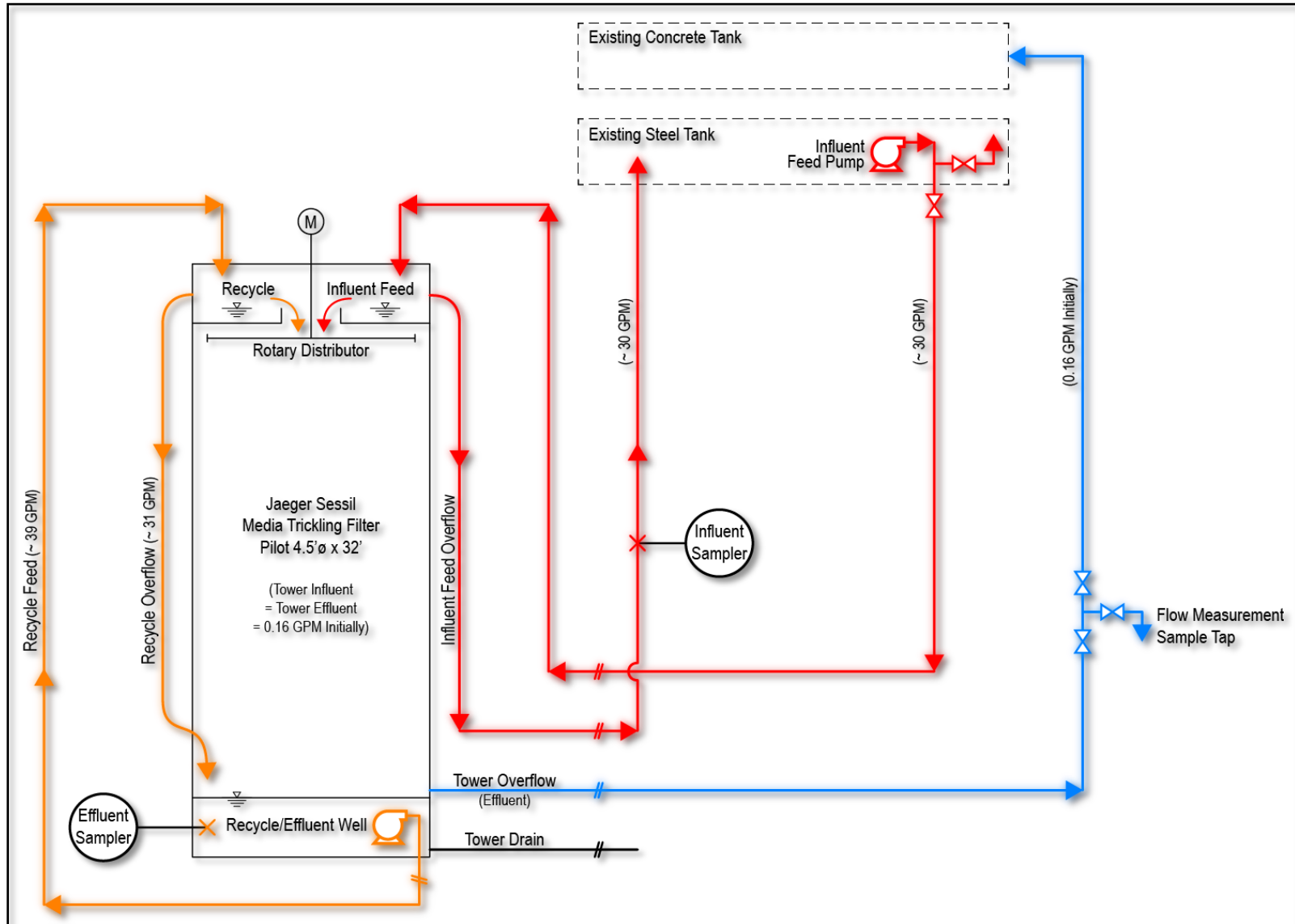
Part 2 - Sessil Media Trickling Filter Pilot

- Biological treatment of raw leachate; no preliminary treatment
- Treatment goal of 70% BOD₅ removal
- Original 12 week schedule
- Startup in Sept./Oct. 2011
- Actual duration of approx. 5 months
 - Oct. – Nov. 2011; 3 month dormant period
 - March – May, 2012

Sessil Media Trickling Filter Pilot

- Design Criteria and Operating Parameters
 - Diameter: 4.5 – ft.
 - Area: 15.9 – sq. ft.
 - Media Volume: 318 cu. ft.
 - Media Depth: 20 – ft.
 - Tower Height: 32 – ft.
 - Min. Wetting Rate: 8 GPM (0.5 GPM/SF)
 - BOD₅ Loading Rate: 38.2 lbs/d (0.12 lbs/d/cu. ft.)
 - Design Influent Flow Range: 0.11 to .016 GPM

Sessil Media Trickling Filter Pilot – Process Schematic





Sessil Pilot Tower Setup and Piping



**Tower Top Flow Distribution Weir Chamber
and Flow Split Challenges**



Pump/Valve Flow Distribution Solution

Sessil Pilot Equipment and Chemical Addition

- Four Pumps (originally 2)
- Influent and Effluent Composite Samplers
- Blower; Media Load Cell
- Rotary Distributor Drive; Control Panel
- Many extension cords and GFIC receptacles
- Chemical Addition:
 - Phosphoric acid (85% - 100 mL) added daily
 - Defoamer added as needed



Sessil Media Strips and Biofilm



Flow Measurement Challenges

Pilot Staffing, Data Recording, and Sampling (Sept. 26, 2011 – June 15, 2012)

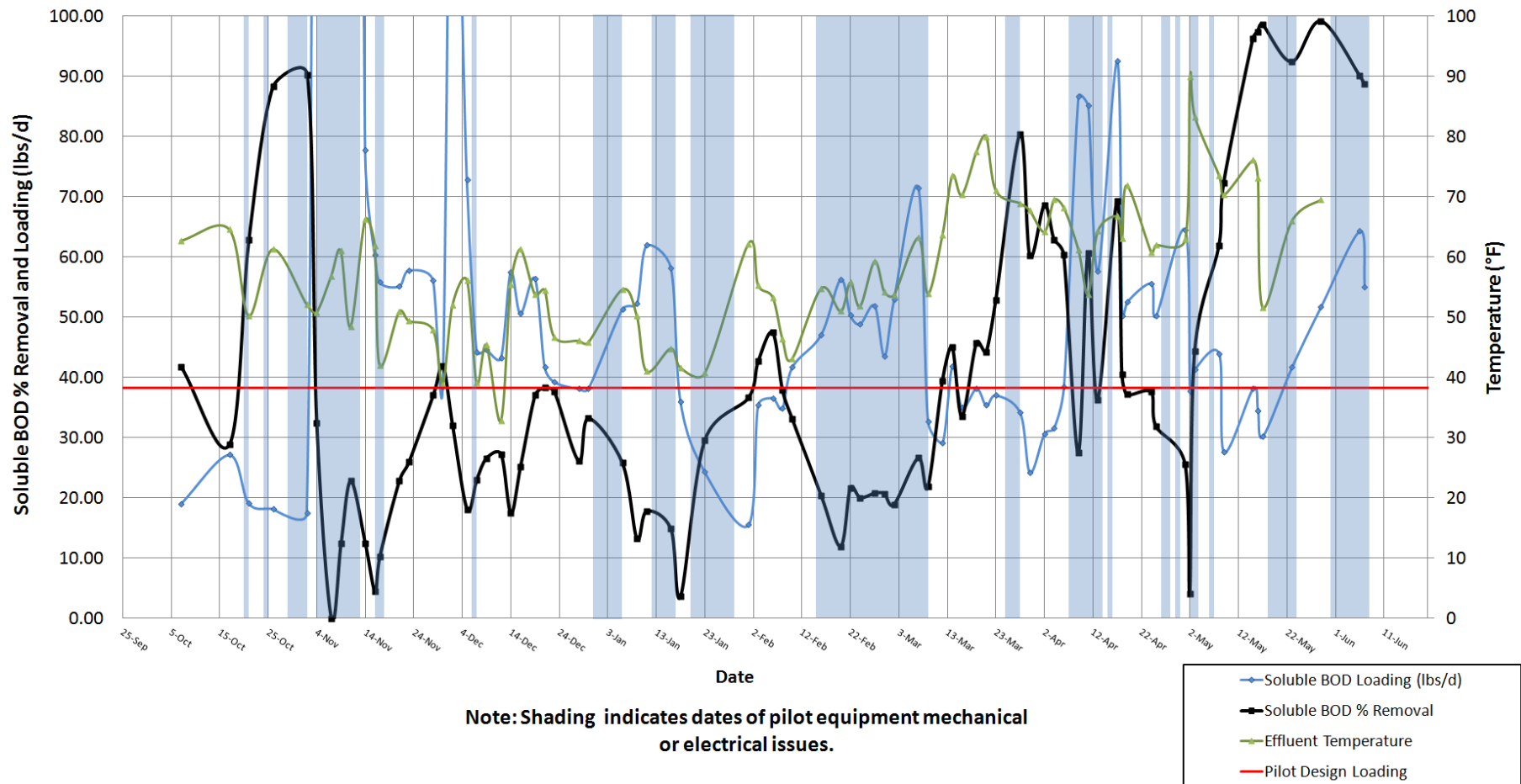
- Daily equipment checks and data recording
- Sampling 3 days/week by Cincinnati State Co-op
- On-site glass fiber filtering for soluble parameters
- 4 months of sampling for 11 influent and 11 effluent parameters
- Sampling later reduced to 3 influent and 3 effluent parameters (TSS, BOD₅, Soluble BOD₅)

Average Influent Parameters in Initial 40+ Samples

Ca	1,900 mg/L
Fe	385 mg/L
TSS	1,670 mg/L
BOD₅	16,600 mg/L
Soluble BOD₅	15,600 mg/L
COD	35,400 mg/L
Soluble COD	31,400 mg/L
TKN	1,640 mg/L
Soluble TKN	1,540 mg/L
NH₃-N	1,735 mg/L
Alkalinity	7,440 mg/L

Overall Sessil Media Pilot Performance

Soluble BOD Removal vs. Loading and Temperature



Media Scaling Concerns and Biofilm Sampling

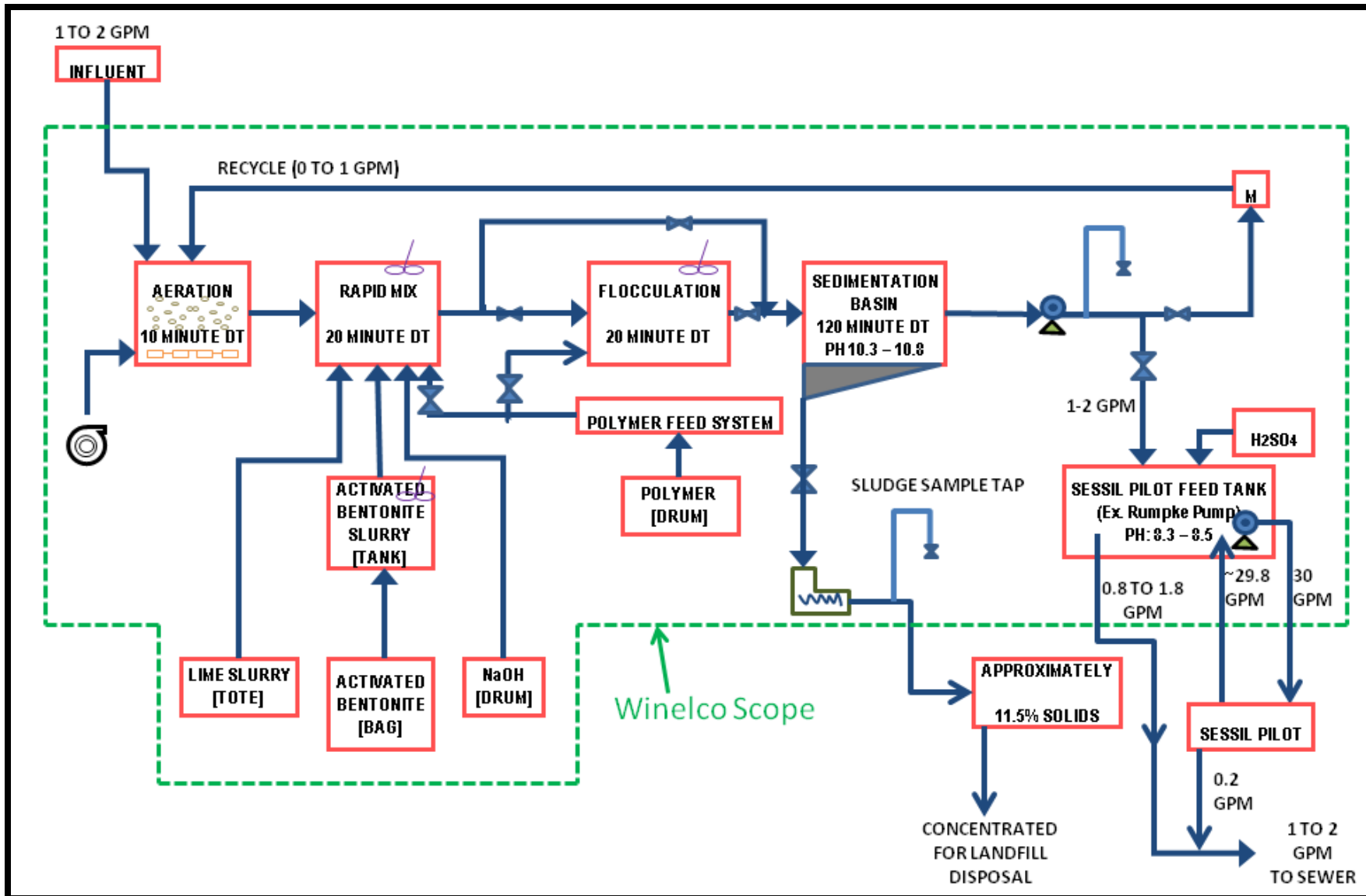
- Biofilm sampled in January and June, 2012
- Analyzed for TS, Ca, Fe, TKN
- Estimates of Biofilm composition assuming biomass includes 12.5% TKN
- January Results: 23% Ca compounds; 4% Fe compounds; 25% Biomass
- June Results: XX% Ca compounds; YY% Fe compounds; ZZ% Biomass

Jar Testing for Chemical Pretreatment

- Objectives: Stabilize water, Reduce Calcium and Iron deposition, Reduce Odor
- Two-liter Phipps and Bird jars and gang stirrers used
- Multiple jar testing events and chemical recipes

Jar Testing Results – Chemical Addition Estimates and Results

- 5,000 ppm of hydrated lime
- 2,000 ppm of acid activated bentonite
- 1,900 ppm NaOH
- 10 ppm of anionic polymer
- Iron removed, calcium reduced, clarity improved



**Chemical/Physical Process Pilot –
Considered, Not Implemented**

ElectroCell Pilot

- Two rounds of piloting: April 30 – May 4, 2012, and May 24-25, 2012
- ElectroCell Technologies, Inc.
- Electrical pulse treatment
- Successful on manure lagoons for nutrient control and odor reduction



ElectroCell Pilot at Tanker Loadout Facility



ElectroCell Pilot and Frac Tank Setup

Conclusions on ElectroCell Pilot

- No significant reduction in parameters of concern
- Possible reduction in odors
- Positively charged ions in leachate (calcium and others) may be inhibiting to electrical pulse treatment
- ElectroCell effluent from second round used as influent to sessil pilot starting June 1, 2012

Next Steps

- Sessil Pilot decommissioned last week
- PTI submittal for a Hauled Leachate Unloading Station in June 2012
- Rumpke continues sampling, analysis, and characterization of leachate
- Establish revised design criteria for a pretreatment facility in the long term
- Continue to haul waste and replace force mains due to deposition buildup in the short term

Acknowledgements

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Questions?

