ST CLOUD WASTEWATER TREATMENT FACILITY

GREATER SUSTAINABILITY

"No Such Thing as Wastewater: St. Cloud's Innovations in Resource Recovery"

April 26, 2015

Mississippi River Forum

CITY OF ST.CLOUD MINNESOTA

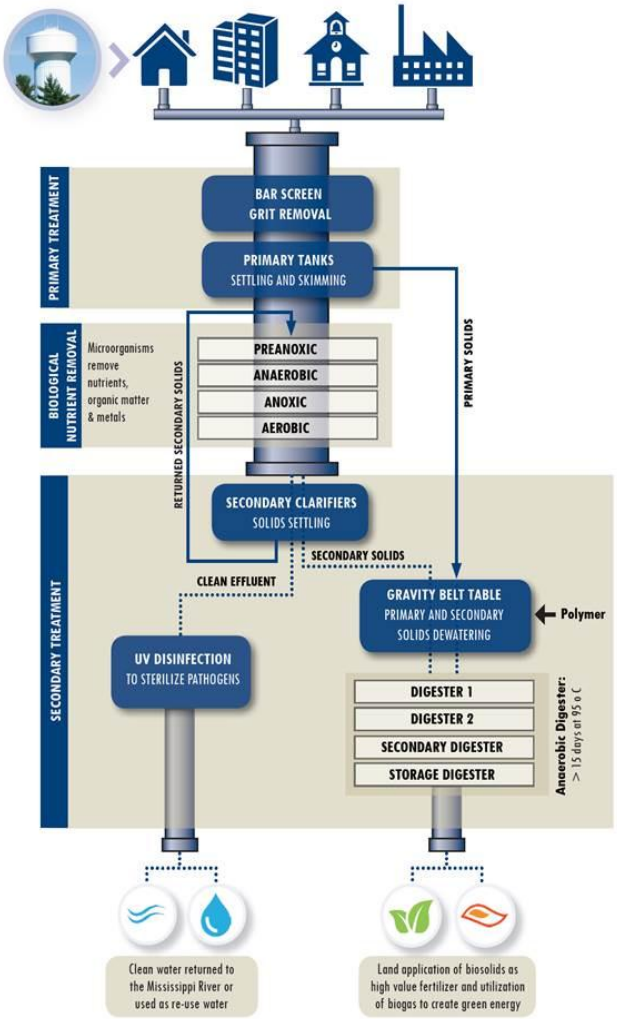
OVERVIEW

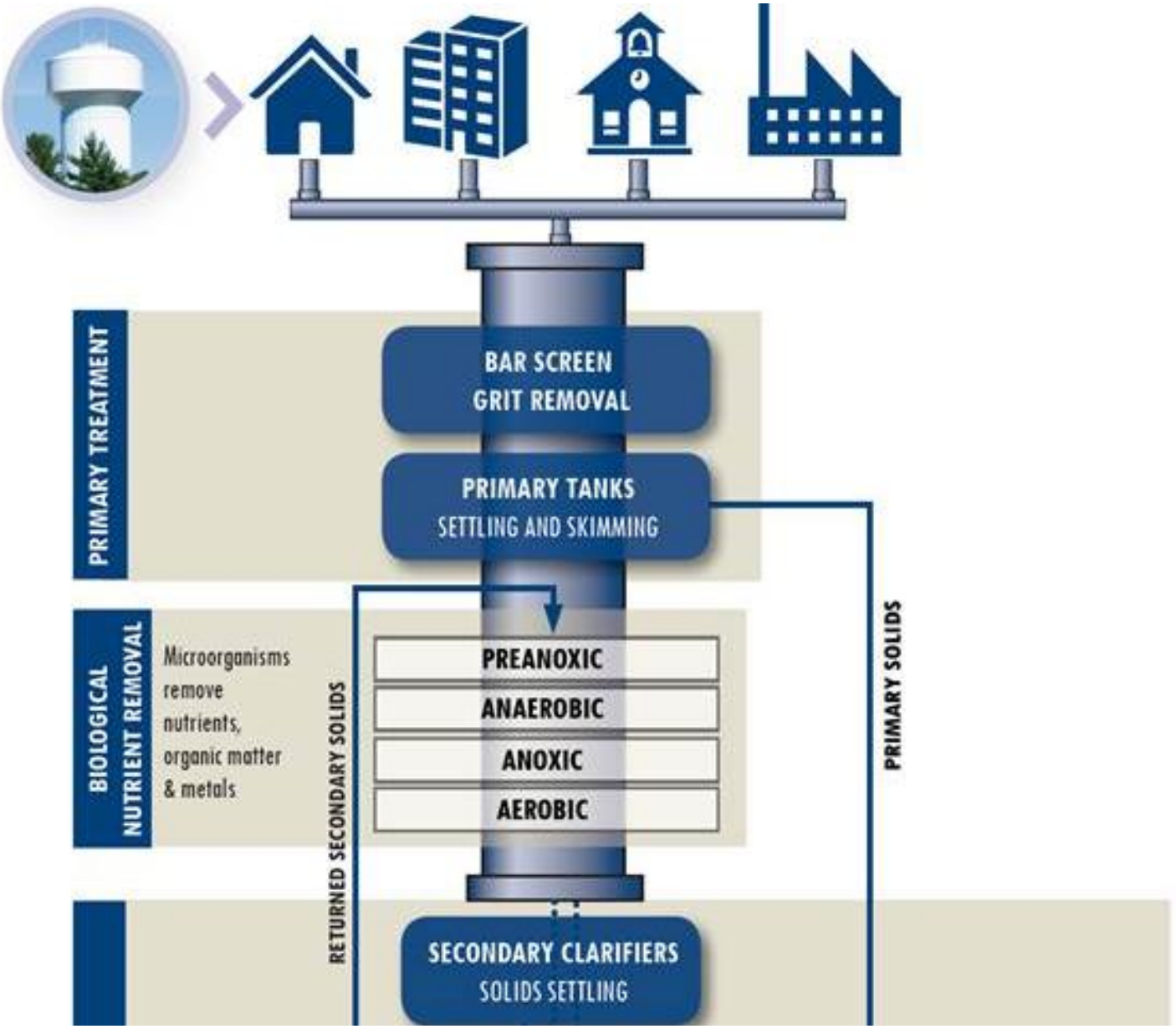
- St. Cloud Wastewater Treatment System
- St. Cloud Biosolids Management Program
- 2014/15 Pilot Projects and Trials
- Resource Recovery and Energy Efficiency Master Planning

WWTF KEY FACTS

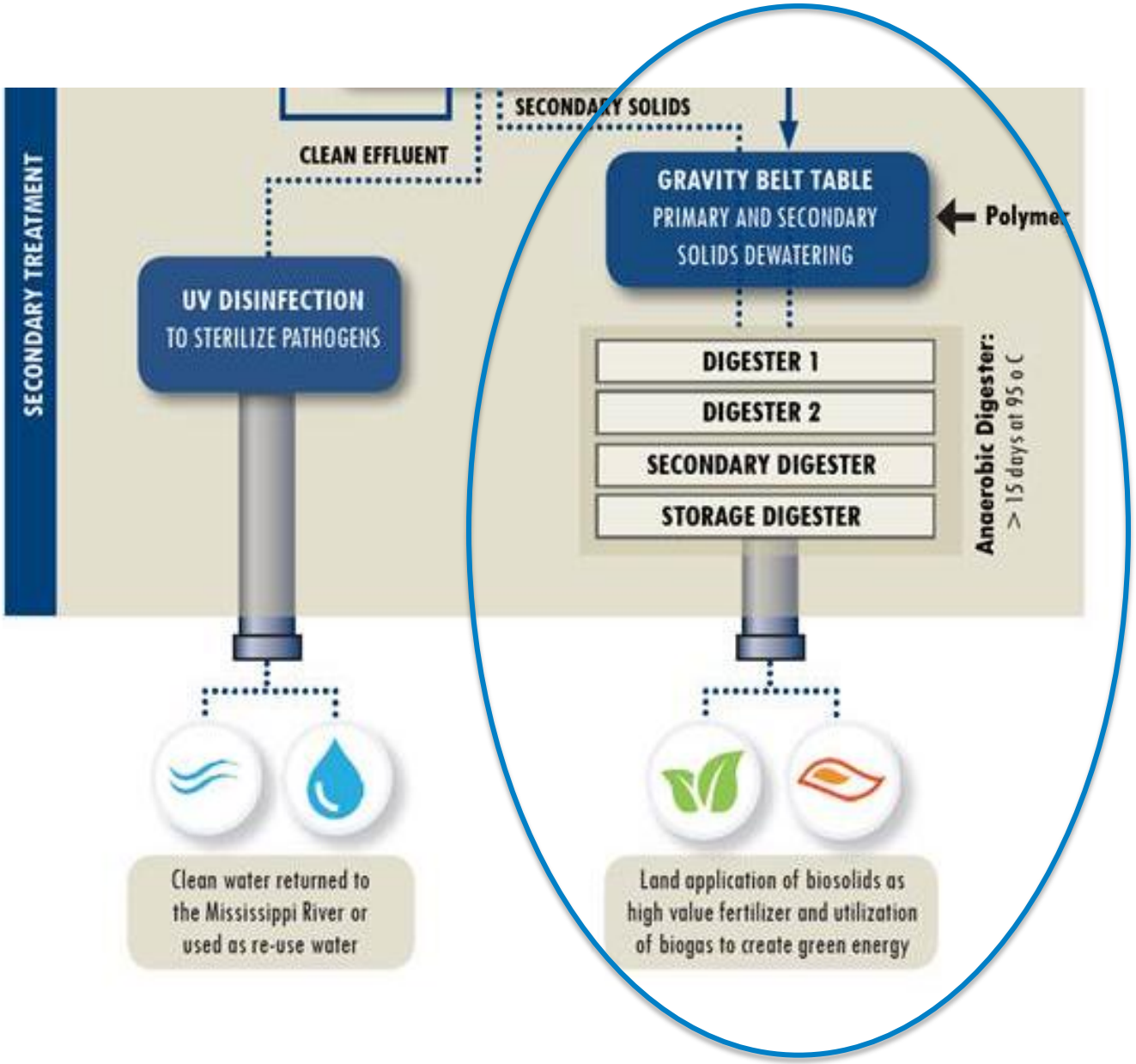
- Design Flow – 17.9 MGD & Average – 10.5 MGD
- Population served ~ 110,000; serves 6 cities
- Staffed 24/7 with 18 FTE
- Meets and exceeds NPDES expectations

St Cloud Wastewater Treatment





Liquid Treatment



Solids Treatment

BIOSOLIDS KEY FACTS

- 35,000 – 40,000 gallons into digester daily
- Thickened to 9% solids by the Gravity Belt Table
- Digested for 30+ days
- Land applied at 3-4% solids
- 2014: 11.7 Million Gallons on 1,423 acres of local land

BIOSOLIDS
MANAGEMENT PROGRAM
Recycling Today | GREATER Tomorrow
(320)255-7226
04 14 2014

POLAR

ST.CLOUD GREATER

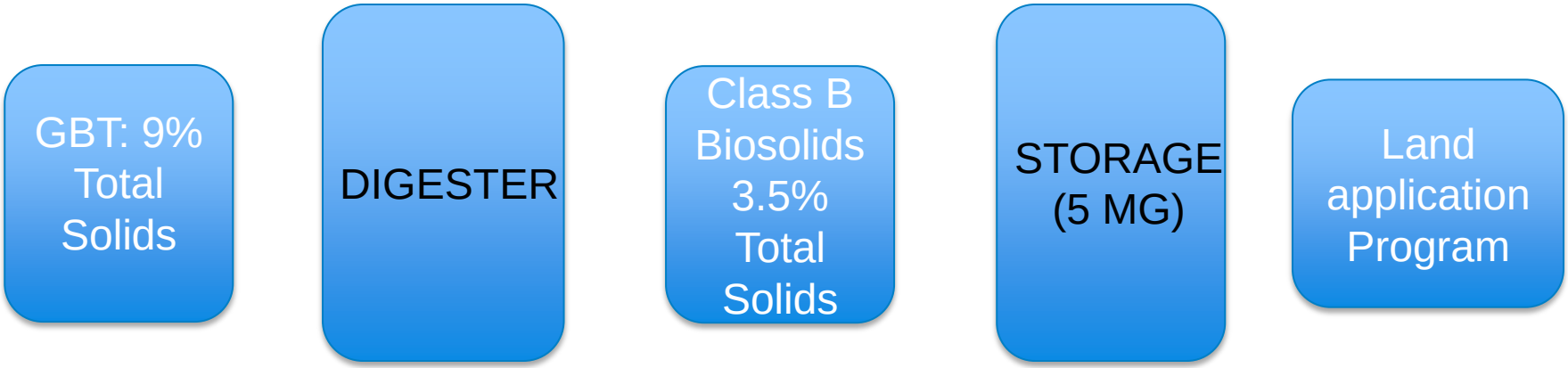
CITY OF ST.CLOUD MINNESOTA

DANGER
CRUSH
HAZARD

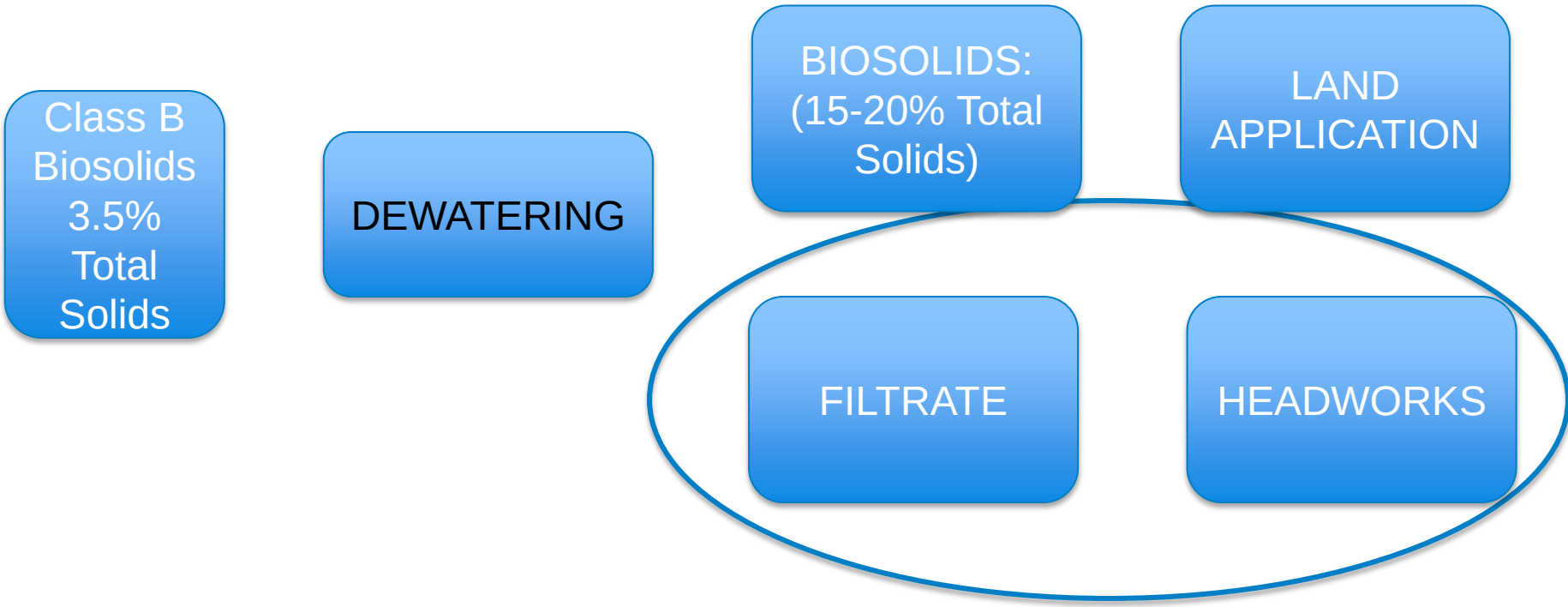
NUHN

St. Cloud Biosolids Management Program

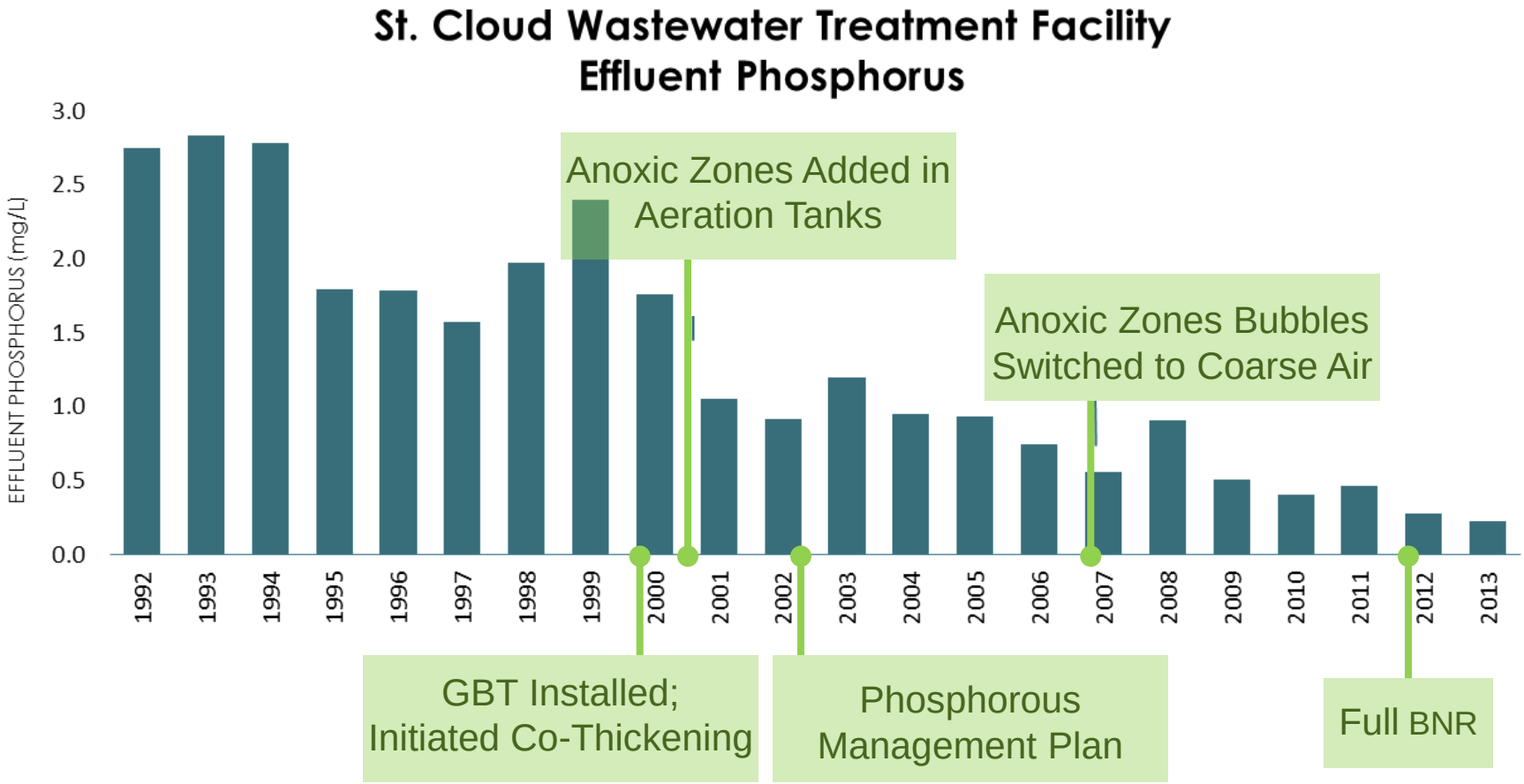
BIOSOLIDS: PRESENT DAY



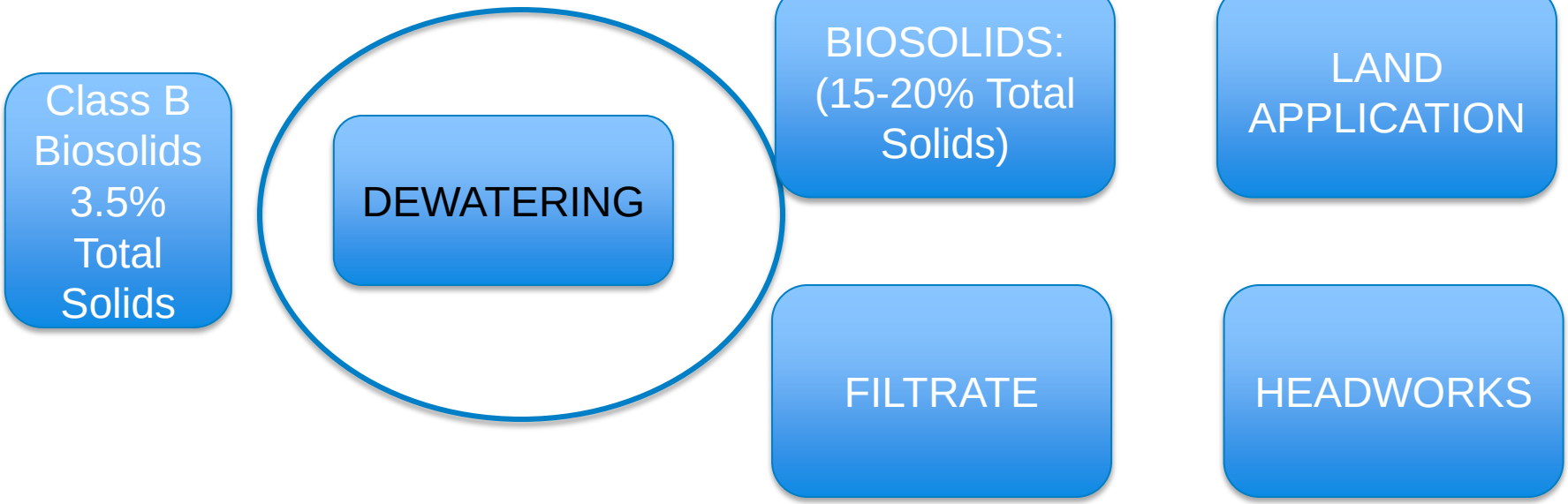
BIOSOLIDS: FUTURE



BRIEF: PHOSPHOROUS AT SCWWTF



BIOSOLIDS: FUTURE



BIOSOLIDS: FUTURE

STRUVITE/2 = FOUR-LETTER WORD

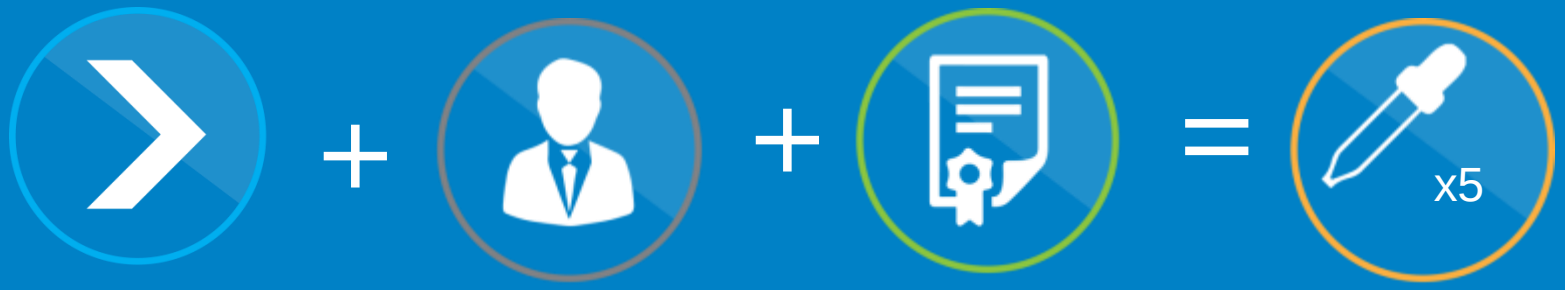
CLEAN WATER LAND & LEGACY AMENDMENT

CITY OF ST.CLOUD MINNESOTA

AE2S

RECYCLED PHOSPHOROUS:

CONTAMINANT OF EMERGING CONCERN?



MPCA Grant: June 2014.

GOALS OF PILOT PROJECTS

- Is the biosolids product dewaterable?
- How much polymer is required to dewater?
- Nutrient concentration of filtrate?
- Can nutrients be harvested from filtrate?

DEWATERING

DEWATERING: Cake

DEWATERING: Filtrate

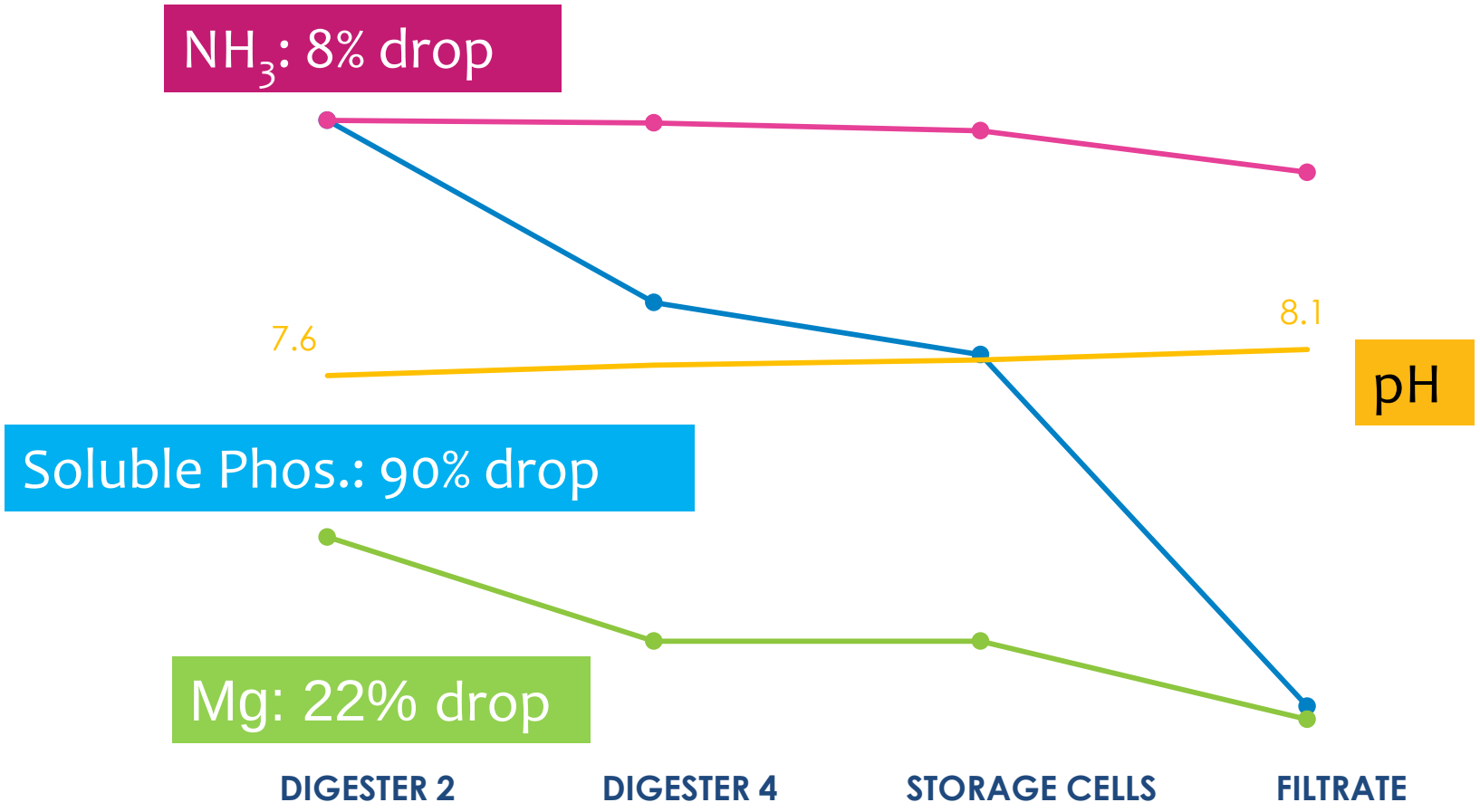
NUTRIENT HARVESTING

Extract Nutrients from filtrate in the form of struvite ($NH_4MgPO_4 \cdot 6H_2O$)

SURPRISING FILTRATE RESULTS

	DIGESTER	BIOSOLIDS STORAGE	BIOSOLIDS HOLDING	FILTRATE
MAGNESIUM (mg/L)	90	50	50	20
AMMONIUM (mg/L)	2,500	2,490	2,460	2,300
PHOSPHORUS (mg/L)	250	180	160	25
PH	7.6	7.8	7.9	8.1

SURPRISING FILTRATE RESULTS



RESCUING THE PILOT: PILOT #5

WASSTRIP: FERMENTING TO CREATE HIGH P SOURCE

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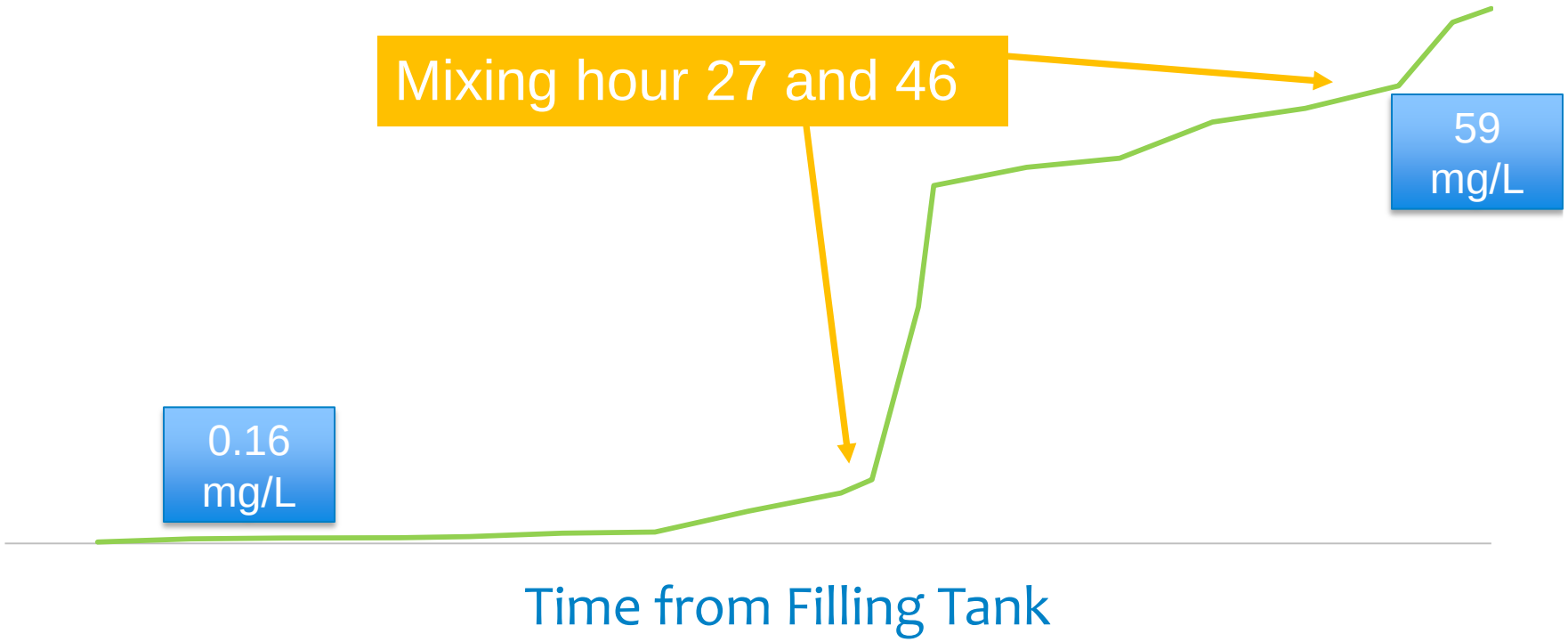
BATCH #1, Soluble P



BLENDING THE STREAMS

	Av. NH3-N (mg/L)	Av. PO4-P (mg/L)
FILTRATE	1,468	32
WASSTRIP	27.8	76
3:1 FEED RATIO	375	66

NUTRIENT HARVEST

NUTRIENT HARVESTING RESULTS

Average P Removal	Maximum Removal	Product Produced
76%	**87%**	**80**lbs

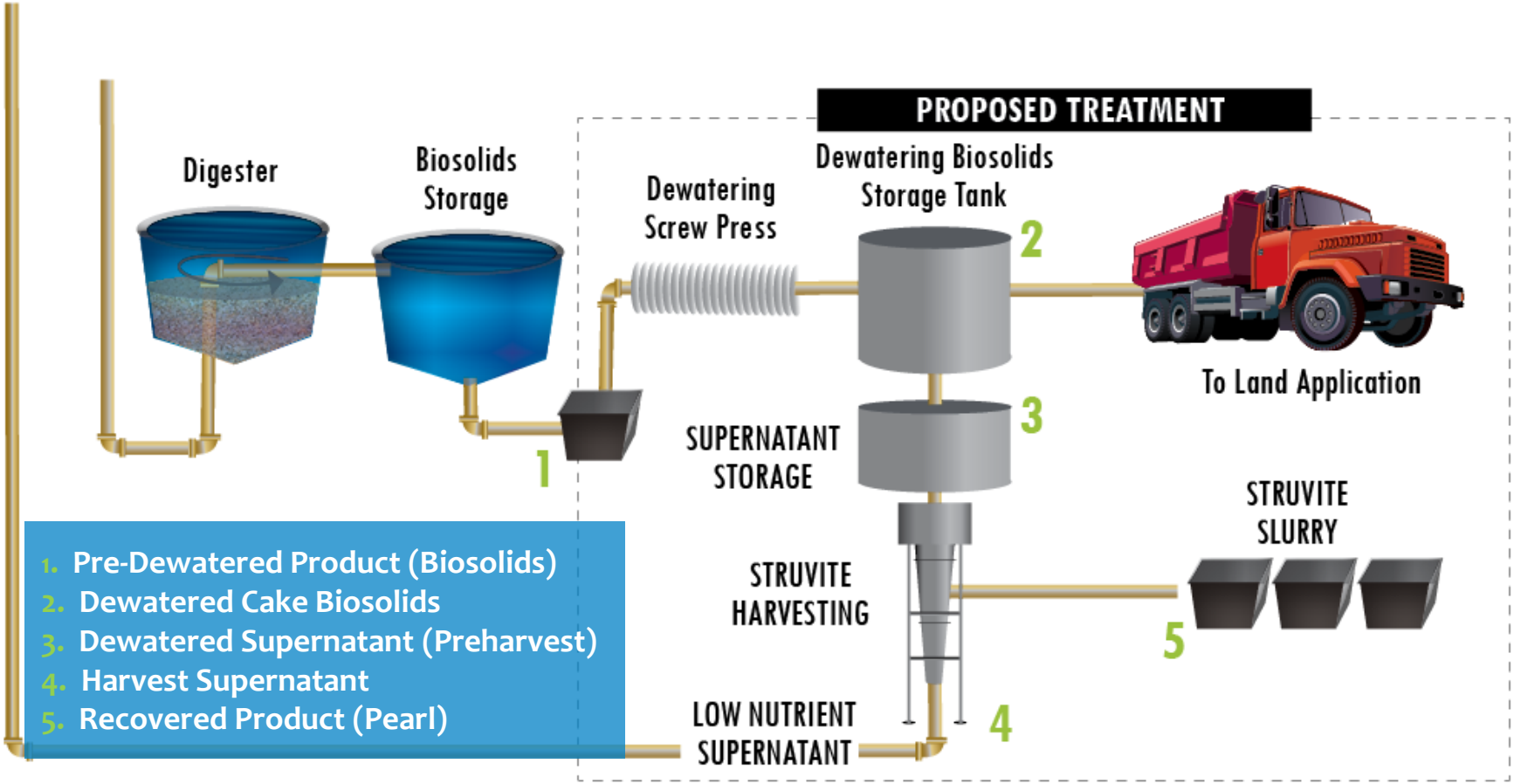
5X PILOT RESULTS: GOALS

- Is the biosolids product dewaterable? YES
- How much polymer is required to dewater?

  A SIGNIFICANT AMOUNT
- Nutrient concentration of filtrate?

  NOT AS HIGH AS EXPECTED
- Can nutrients be harvested from filtrate?

  YES, IF NUTRIENTS ARE PRESENT AT CORRECT CONCENTATIONS


PROPOSED TREATMENT
Digester
Biosolids Storage
Dewatering Screw Press
Dewatering Biosolids Storage Tank
2
To Land Application
SUPERNATANT STORAGE
3
STRUVITE SLURRY
STRUVITE HARVESTING
5
LOW NUTRIENT SUPERNATANT
4
1
1. Pre-Dewatered Product (Biosolids)
2. Dewatered Cake Biosolids
3. Dewatered Supernatant (Preharvest)
4. Harvest Supernatant
5. Recovered Product (Pearl)

SINCE THE PILOTS

- Resource Recovery and Energy Efficiency Master Plan
- Addition of High Strength Waste to Digesters: Trials
- Biosolids Alternatives: Lystek
- Energy Reduction and Energy Production

R2E2 Master Plan

Resource Recovery & Energy Efficiency

R2E2 Master Plan

Resource Recovery & Energy Efficiency

ENERGY GOALS

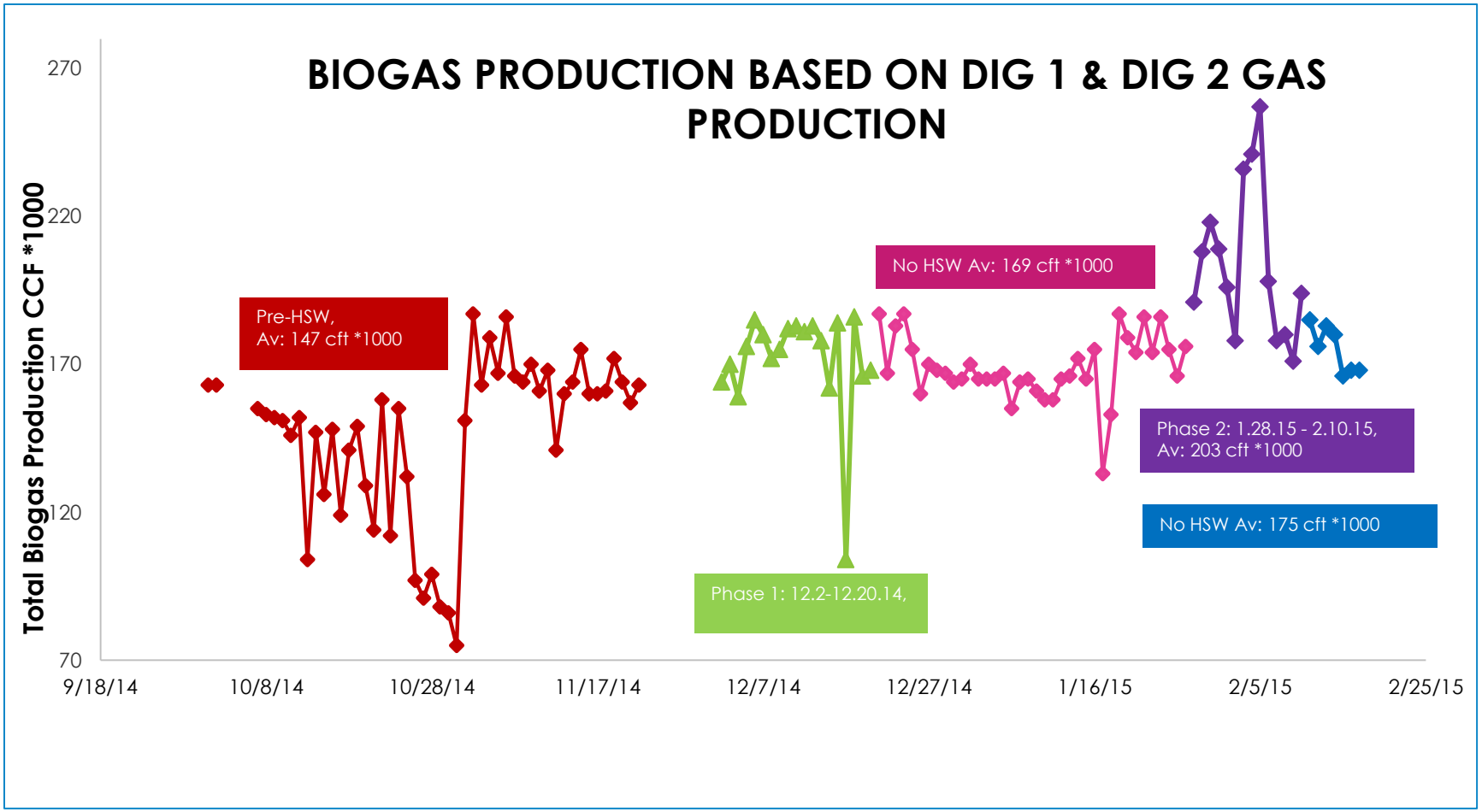
Timeframe	Performance
5 years	25% reduction in energy purchased
10 years	50% reduction in energy purchased
20 years	75% reduction in energy purchased

High Strength Waste Trials

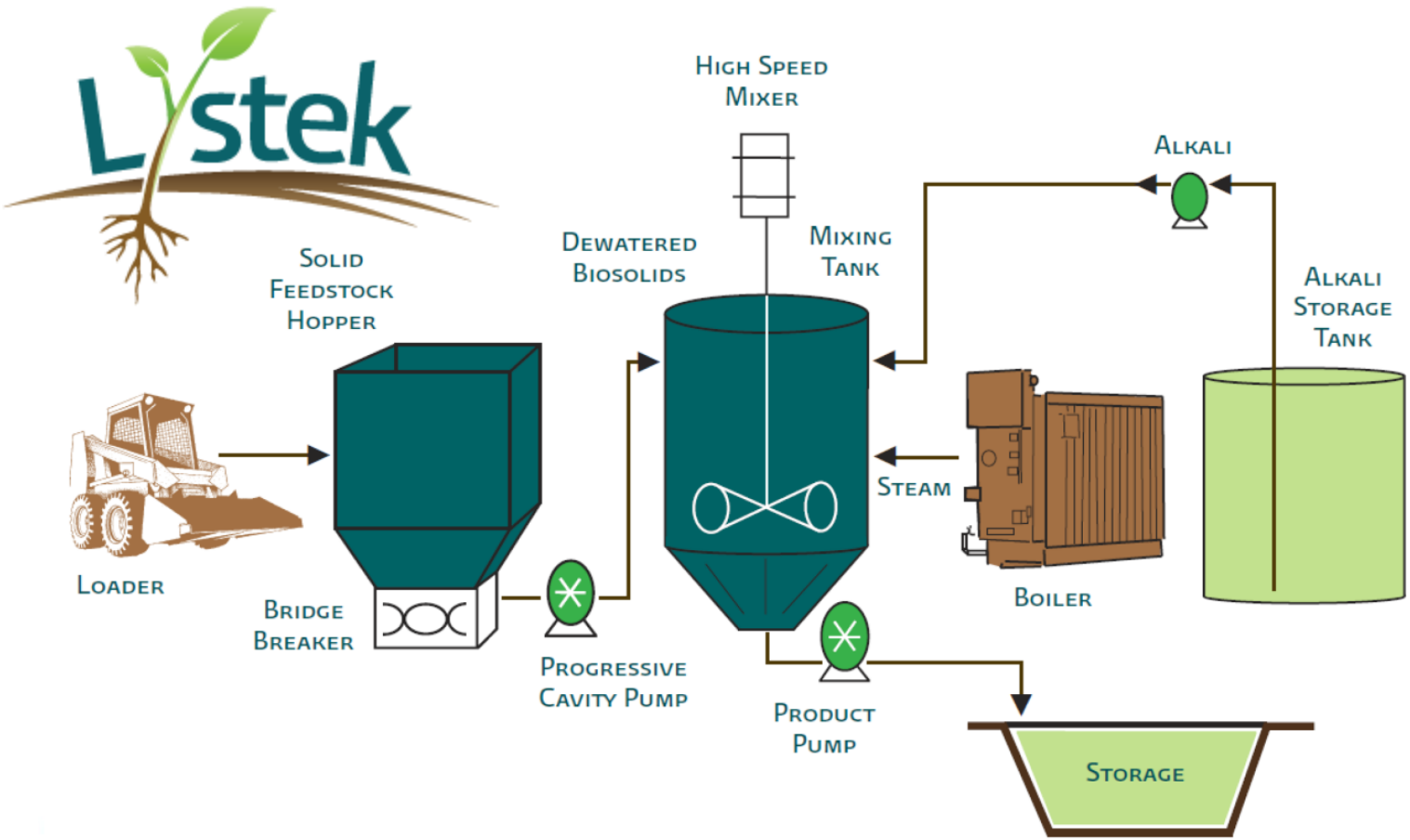
Waste to Energy

Digester Feed	m3 CH4/ton of raw material
Pre-Biosolids (Sludge)	20
Brewery Waste	75
Used Grease	250

High Strength Waste Trials



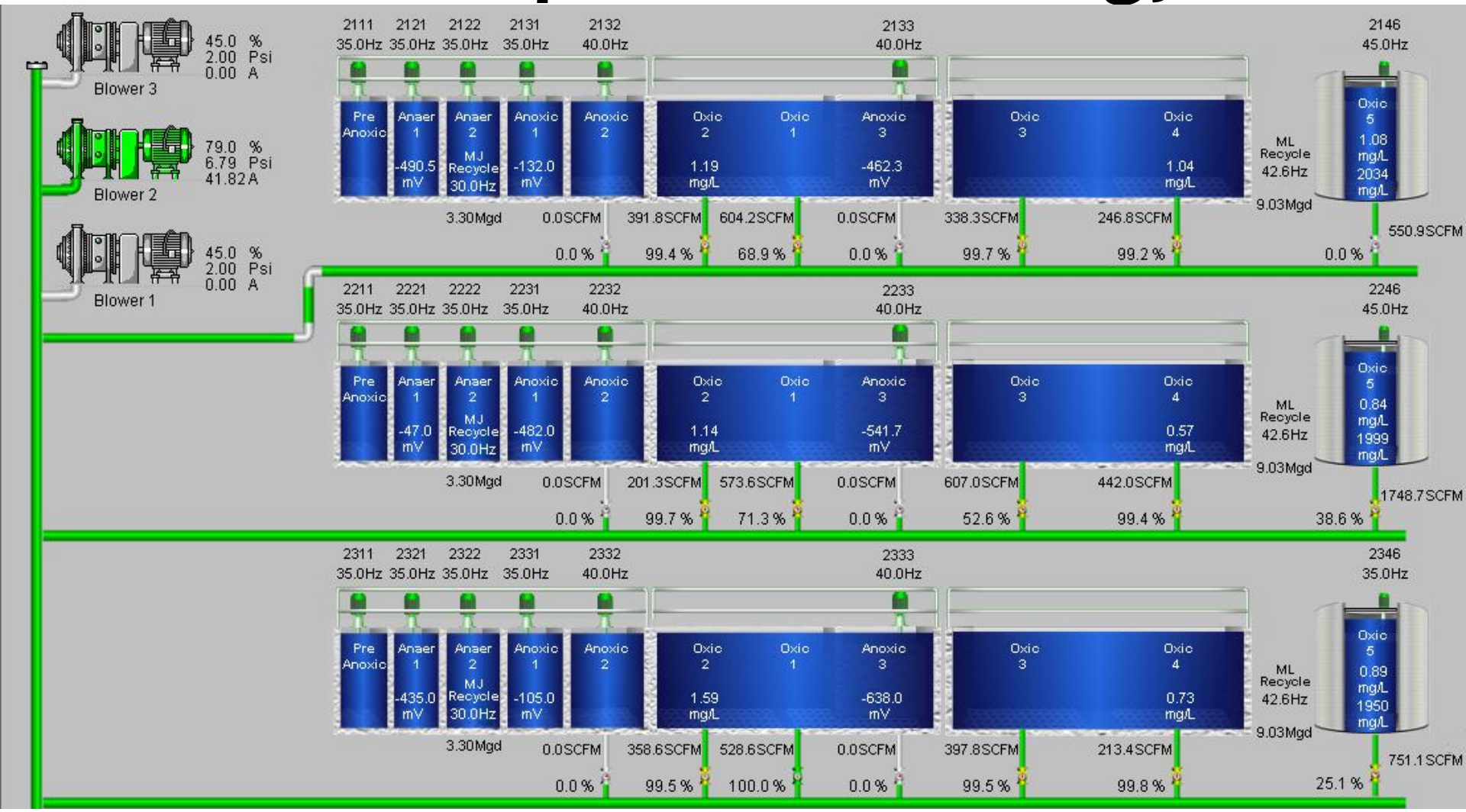
Biosolids Alternatives - Lystek



Energy Reduction & Production

Optimizing Aeration System

Most Open Valve Strategy



Energy Reduction & Production

Results

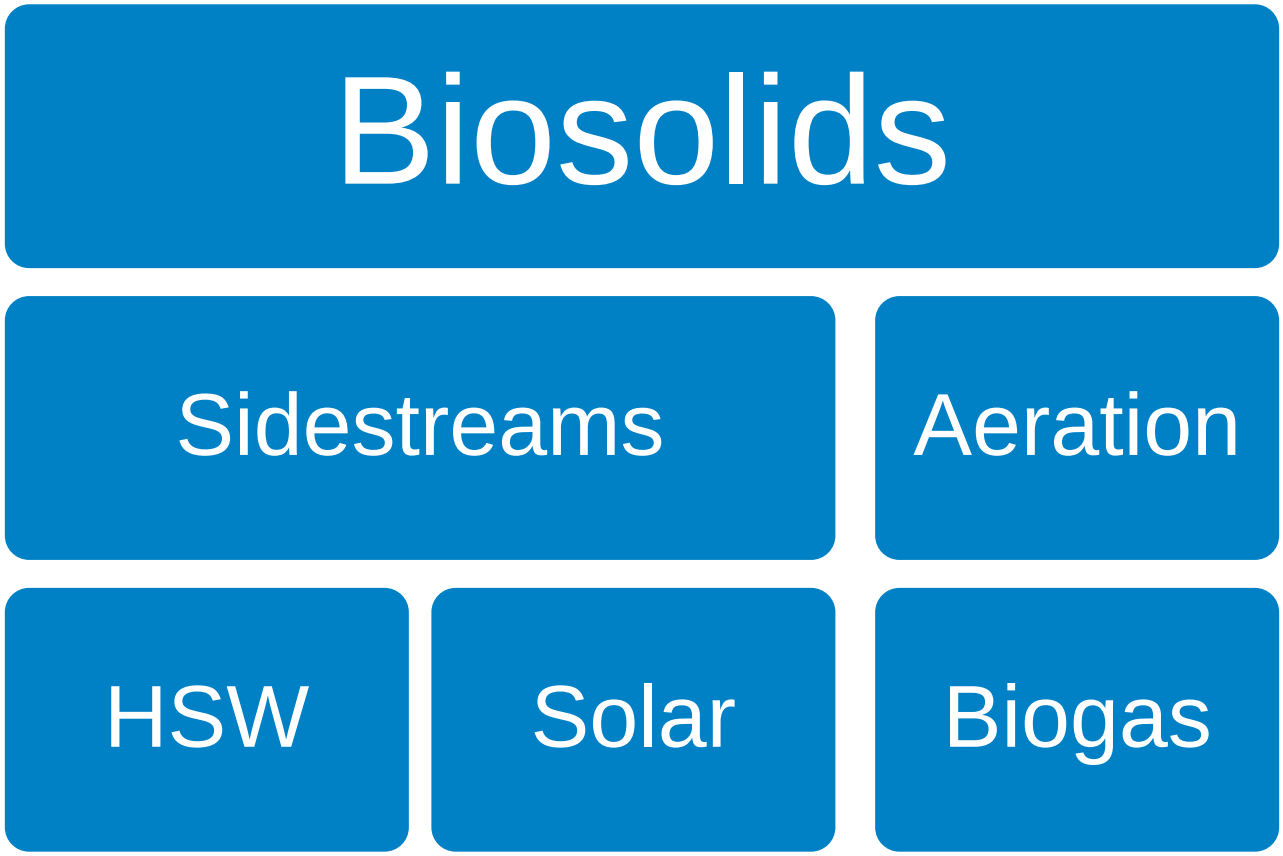
	2013 Energy Demand (kW)	2014 Energy Demand (kW)	Energy Savings (kWh/mo)	Cost Savings ($/mo)
August	644	572	51,400	$3,700
September	674	546	92,400	$6,700
October	635	516	85,800	$6,200

St. Cloud Wastewater Treatment

Exciting Future

- Paradigm Shift from Wastewater Treatment to Resource Recovery
- Energy Consumer to Energy Provider

R2E2 Master Plan



QUESTIONS?

BE PART OF SOMETHING

GREATER