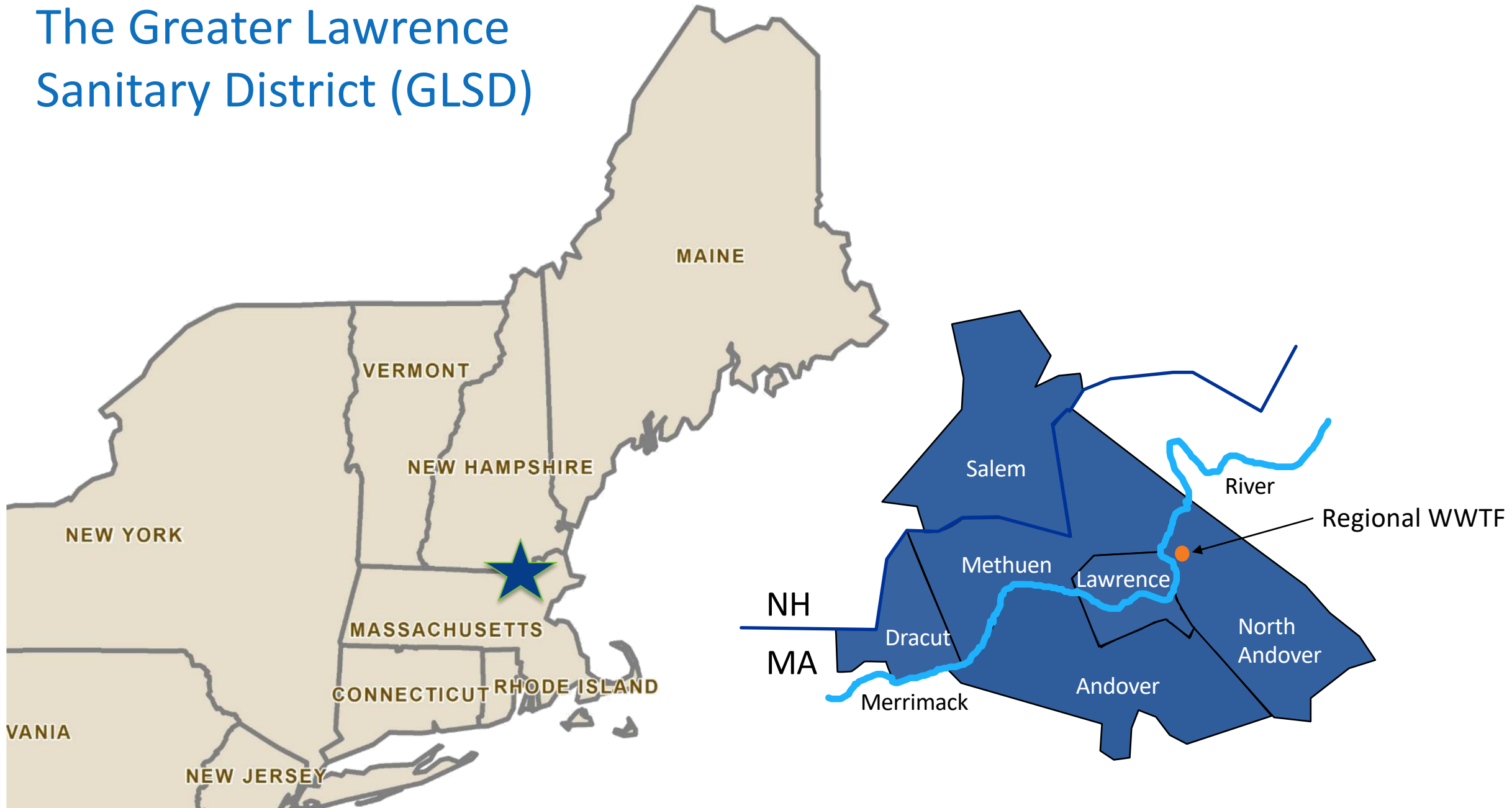


# GREATER LAWRENCE SANITARY DISTRICT



**Organics to Energy Project  
Co-Digestion And the Path to Net Zero Energy Use  
NEWEA, January 30, 2019**

# The Greater Lawrence Sanitary District (GLSD)



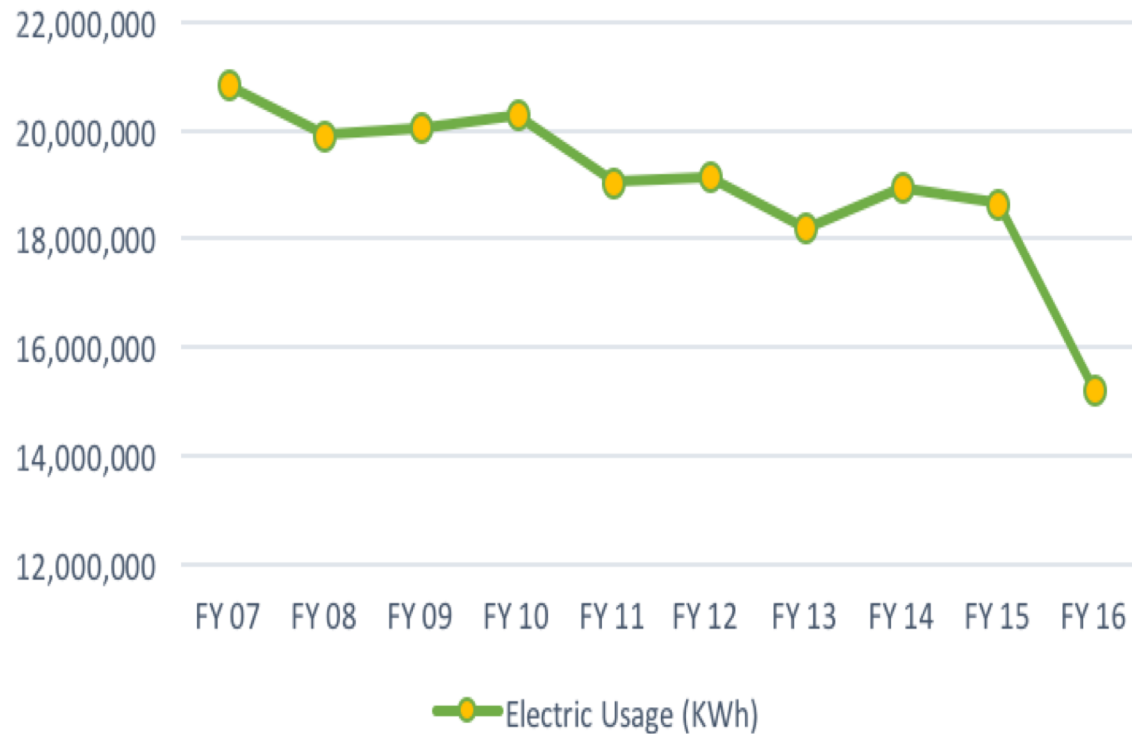
# GLSD BACKGROUND & FAST FACTS

- Established by Massachusetts Legislation in 1968
- WWTP Operational Since April 1977
- Government Entity, Governed by a Board of Commissioners from Communities Serviced
- Regulated by Permits issued by US EPA & MADEP
- Second largest WWTP in Massachusetts (52 mgd avg day / 135 mgd peak)
- Class A Biosolids Heat Drying Facility Built in 2002, Manufactures ~ 5,000 Tons/Yr of Fertilizer Pellets
- 100% of Class A Fertilizer is sold to local farmers and landscapers every year
- Exceptional Record of Compliance, Safety and Innovation to Serve our Communities



# ENERGY EFFICIENCY SAVING PROJECTS

## GLSD Electric Usage (KWh)



- Installation of VFD's for motors 25 hp and larger
- Initiated operational measure changes such as control improvements
- Installed new efficient dual fuel boilers DG/NG for building heating
- Installed an energy management system for building heat
- Installed energy efficient lighting
- Installed a 410 kw of solar array

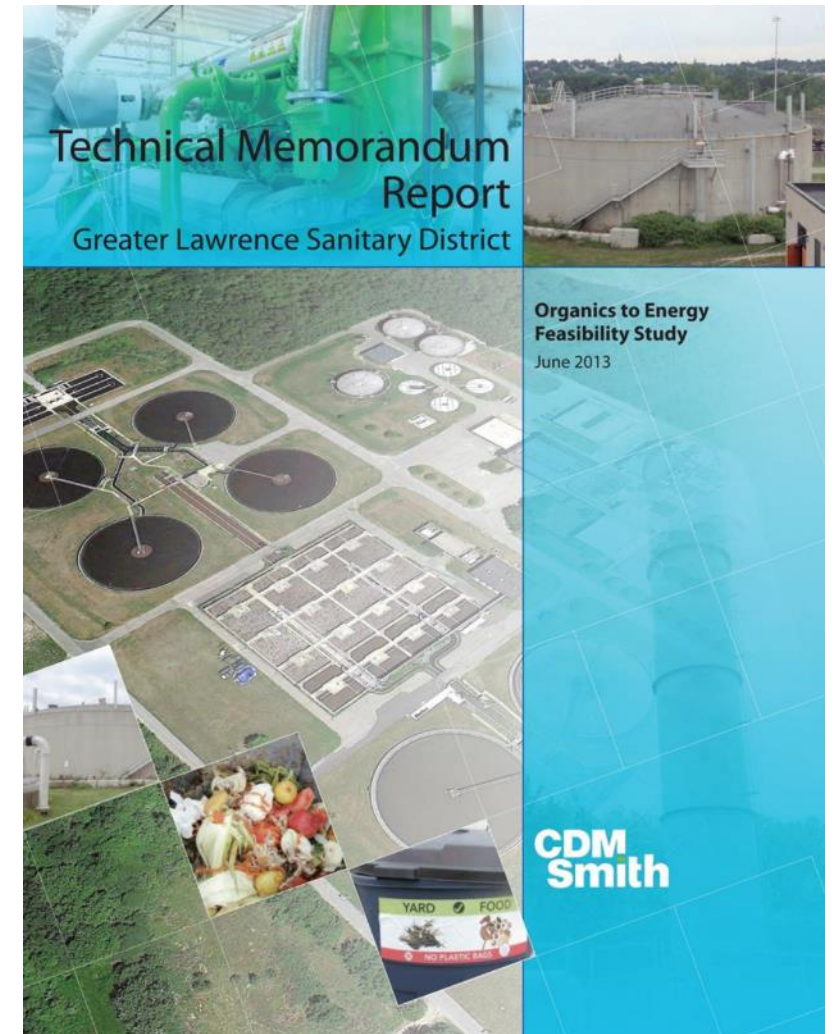
# Massachusetts Organic Waste Disposal Ban



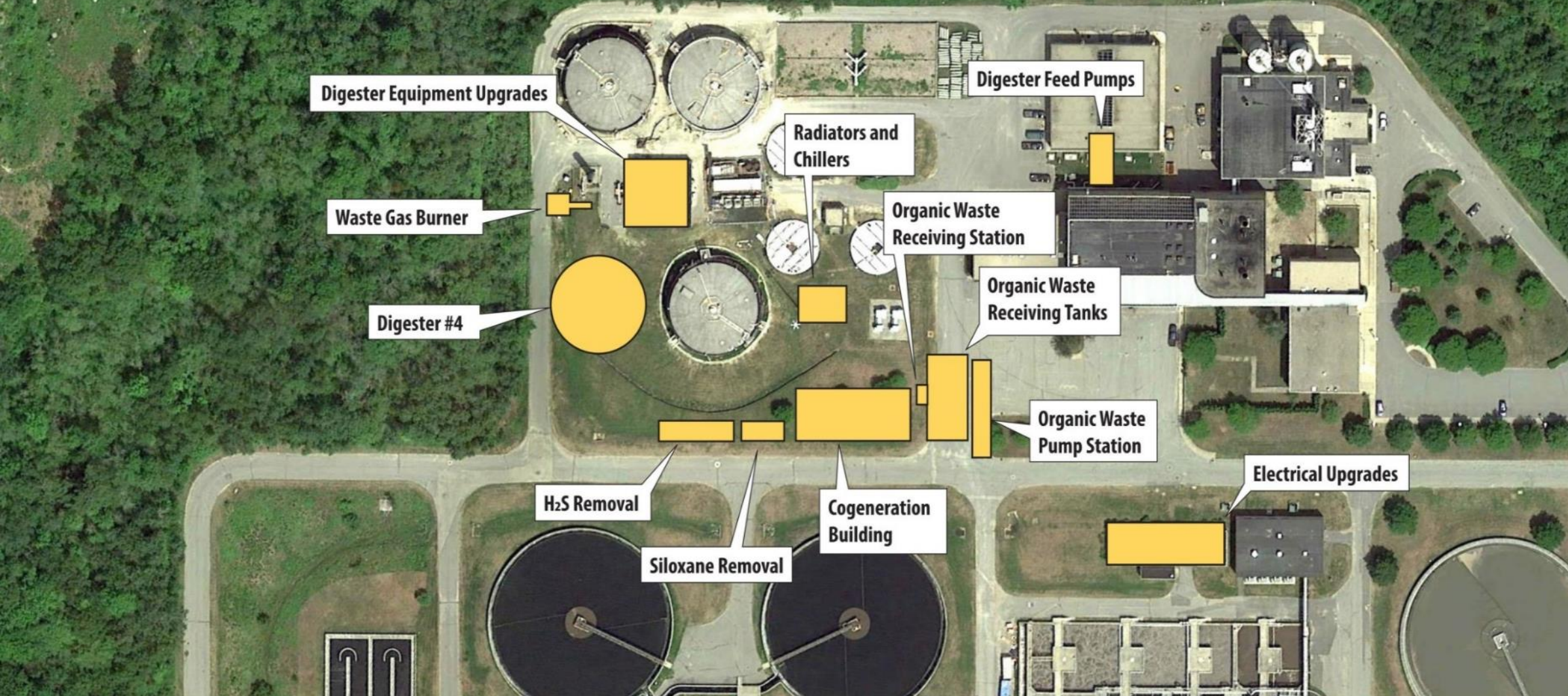
- Effective October 1, 2014 – Producers of >1 ton of food waste per week banned from landfills or incinerators
- Food waste must now be diverted to Food Kitchens, or recycled through composting or anaerobic digestion
- Impacts hotels, restaurants, universities, hospitals, supermarkets, food processors and wholesalers
- The Massachusetts State Master Plan targeted diversion of >35%, or over 350,000 tons per year of Source Separated Organics (SSO), by 2020.
- Long-term target is 80% diversion by 2050

# GLSD Co-Digestion Feasibility Study (June 2013)

- GLSD could handle ~28,000 gpd of SSO material in existing digestion system
- Could accept up to 92,000 gpd of SSO material with addition of 4<sup>th</sup> digester
- GLSD has the potential to generate >100% of its WWTP energy needs using 100% renewable energy
- Project could eliminate \$2.8 M annual electrical costs & provide stable back up power to facility
- At full capacity, GLSD will meet a sizable fraction of the State's goal for SSO diversion based on DEP projections



# GLSD Organics to Energy Project Components



# Food Waste Conversion to EBS<sup>®</sup> (Engineered Bioslurry)





# TYPICAL SSO (WM EBS) CHARACTERISTICS



- pH: 3.75
- TSS: 9.15 %
- % TS: 14
- % VS: 93
- %VS/TS 85%
- Total COD: 269,000

# Combined Heat & Power (CHP) Production

- Two reciprocating CHP generators
- Total capacity of 3.2 MW
- Space for future third engine
- Power fed to site electrical system and net metered to the utility grid
- Projected avg power demands:
  - Plant: 1,700 kW (onsite)
  - RSPS: 700 kW (via net metering)
- Heat captured to supply digesters and other on-site heating demands



# GLSD Energy Upgrades & Benefits

- Dual Fuel Engines – Biogas/Natural Gas
- Biogas is a 100% Renewable Energy
- 20% reduction in annual net GHG Emissions
- Energy benefits alone equivalent to removing 1,035+ cars from the road (MA DOER)





# Co-Digestion Pilot Program



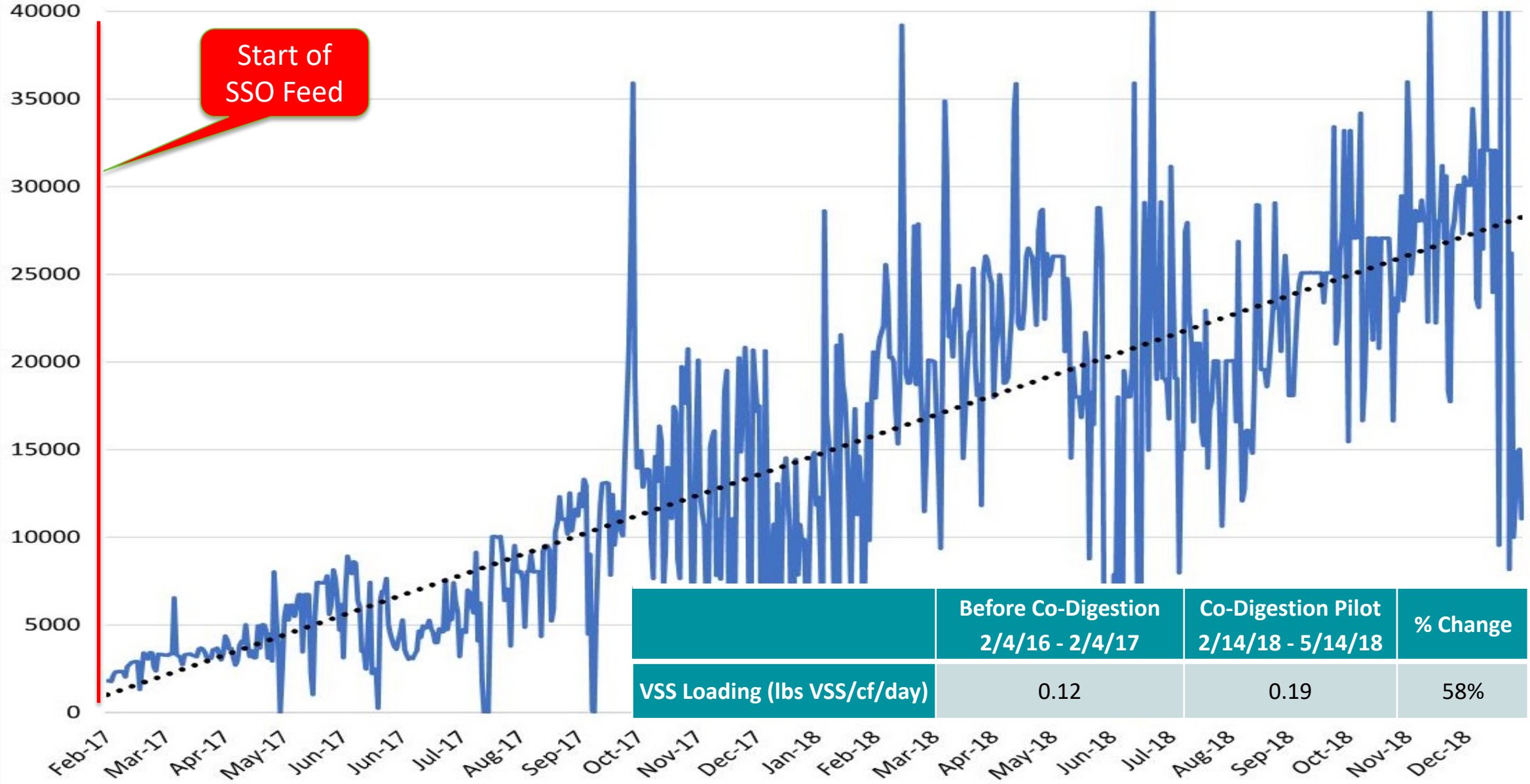
- Assess the logistical issues associated with receiving and processing the material.
- Determine impacts on:
  - Digestion operating parameters (pH, VFA/Alk, etc, etc)
  - Solids production
  - Gas production
  - Dewatering and thermal drying

# Typical Process Performance Before Co-Digestion

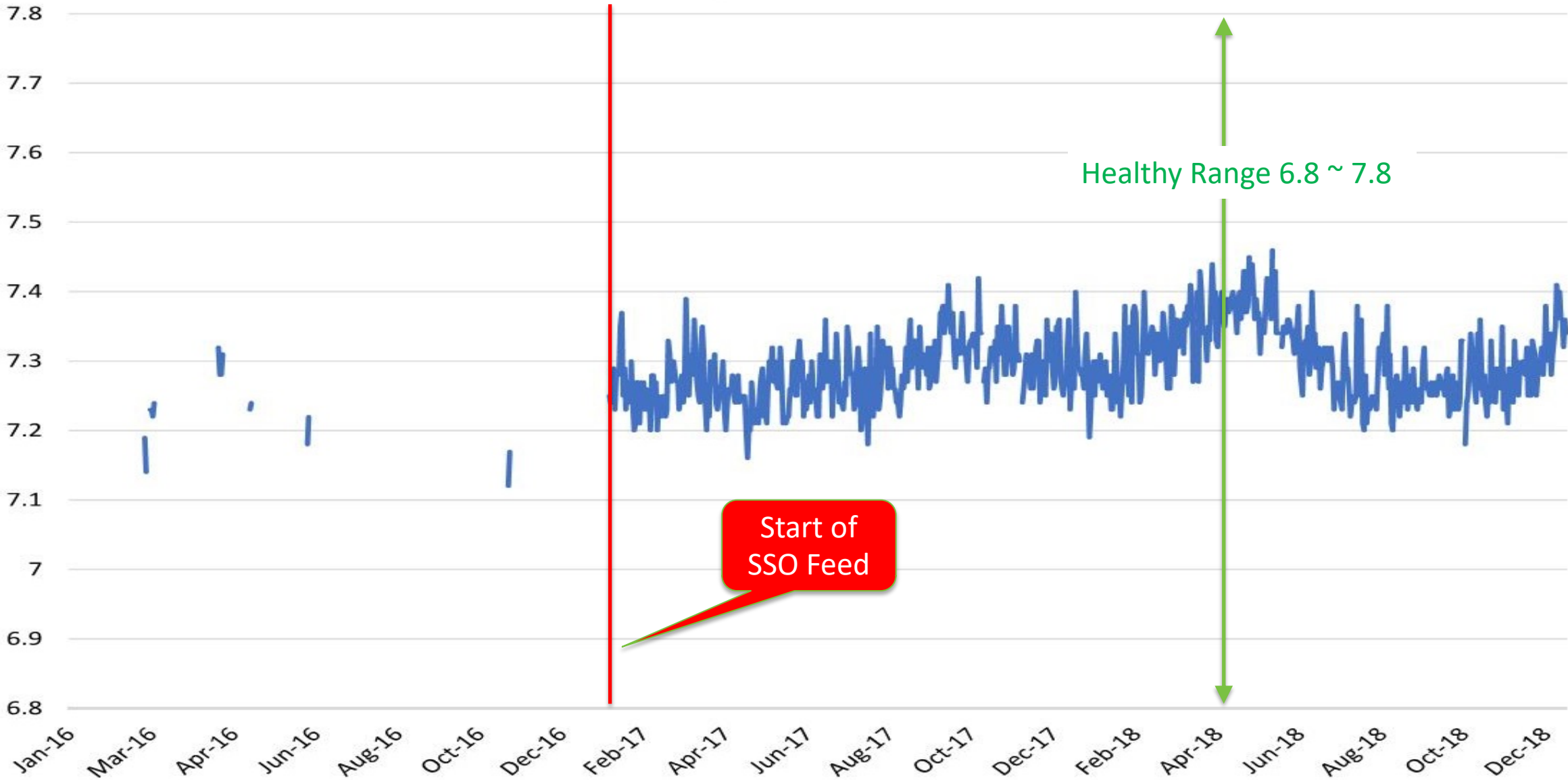
■ Feed	165,000 gpd
■ Feed Solids	4.3%
■ Digestate Solids	2.1%
■ VSS Reduction	64.3%
■ Overall Solids Reduction	48.3%
■ Detention Time	18.4 days
■ Total Biogas Production	441,000 cf/d



# SSO Feed (gpd)

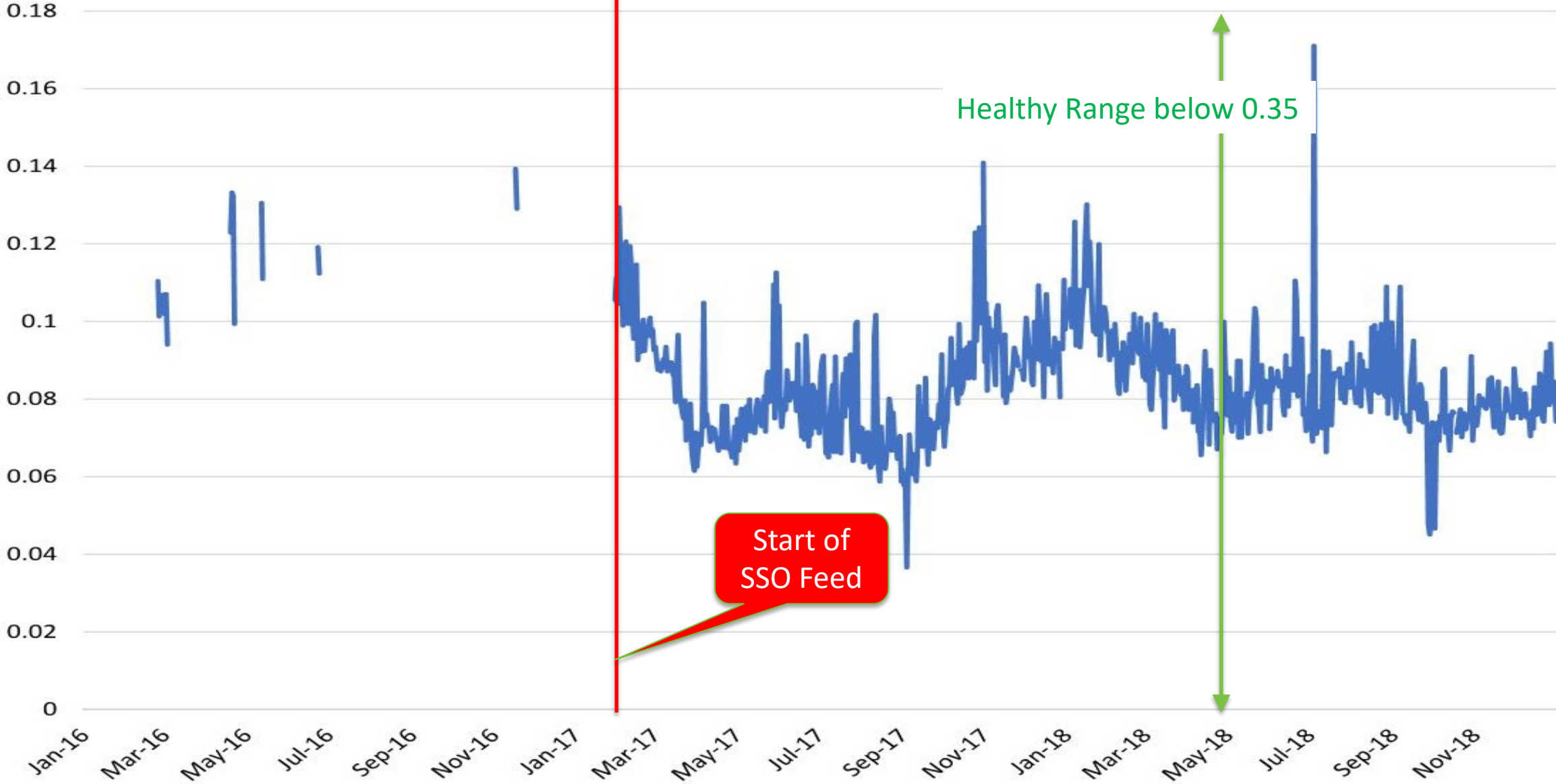


# Digester pH

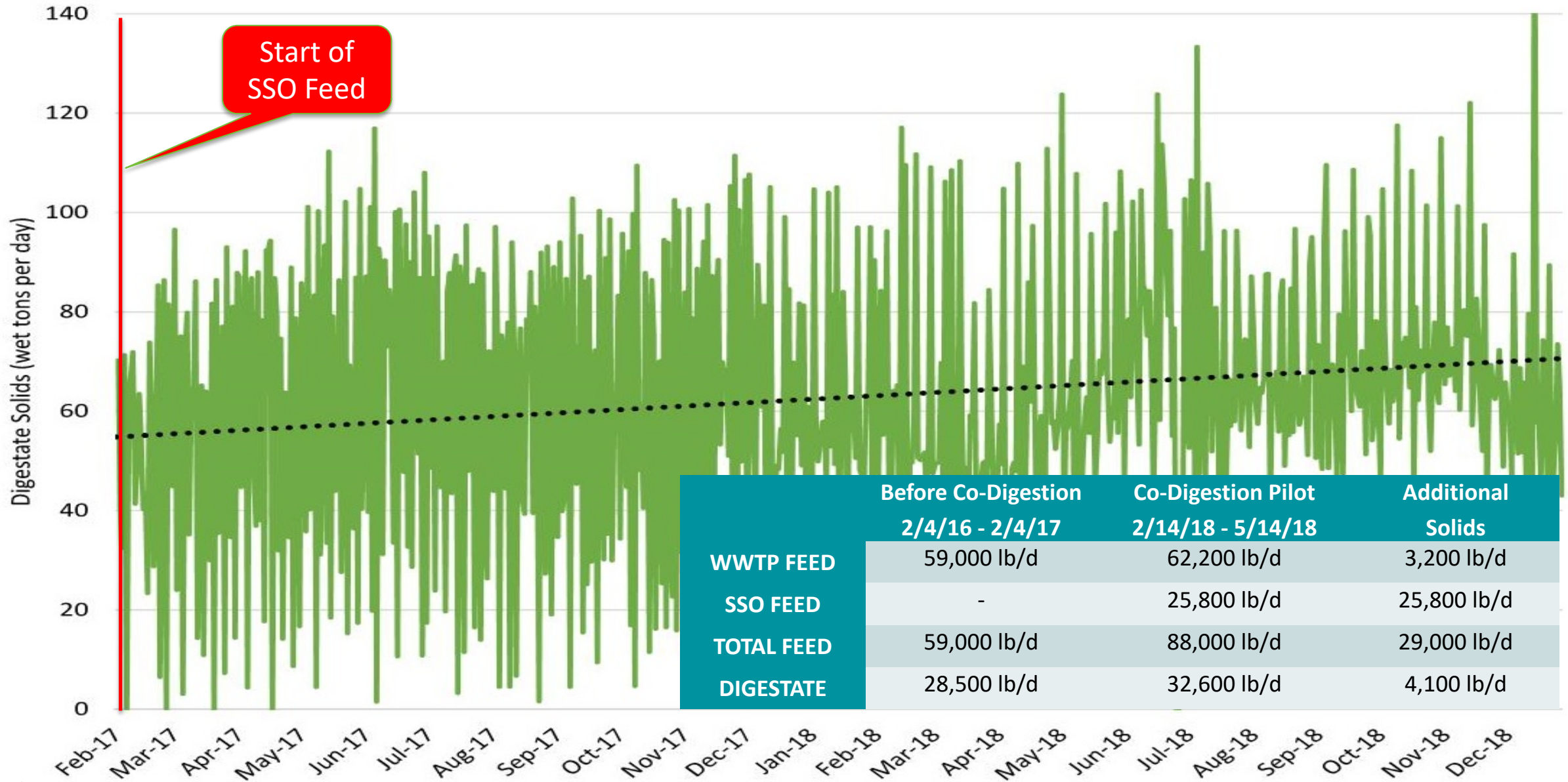




# Digester Volatile Acid to Alkalinity Ratio



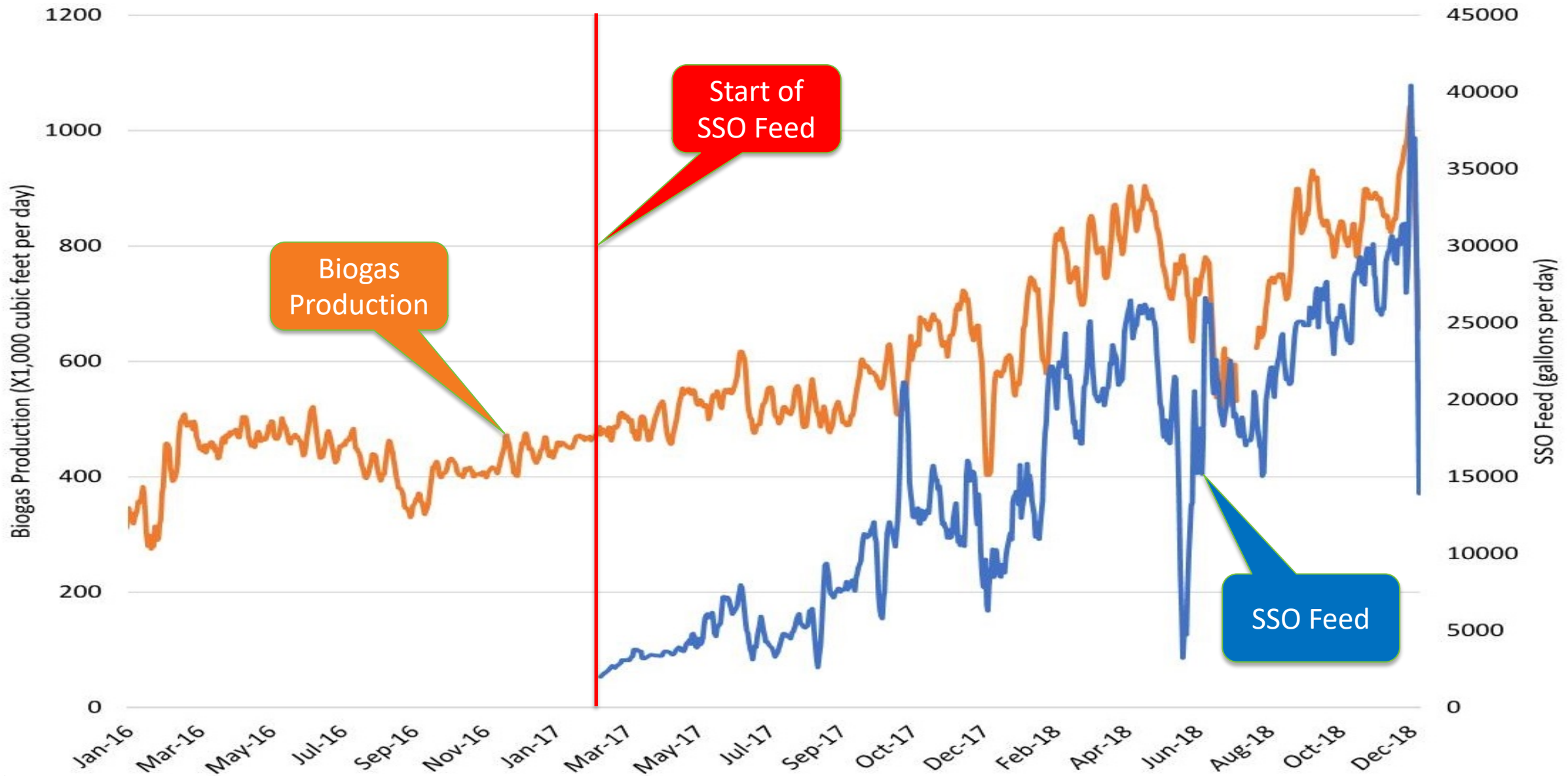
# Digester Digestate Solids



# Biogas Production

		Before Co-Digestion 2/4/16 – 2/4/17	Pilot 2/14/18 - 5/14/18	% Change
<b>TOTAL FEED</b>	Volume (gal/day)	165,000	151,000	-8%
	Dry Weight (lb/day)	59,000	88,000	49%
<b>TOTAL PRODUCTION</b>	VSS Reduced (lb/day)	30,500	55,300	81%
	Total Biogas Production (cf/day)	441,000	789,000	<b>79%</b>
<b>UNIT PRODUCTION</b>	WWTP Biogas production rate (cf/gal)	2.68	<b>3.73</b>	39%
	SSO Biogas production rate (cf/gal)	-	<b>14</b>	-

# Biogas Production (7-day moving average)



# CHP System Start-Up

- **Schedule:**
  - Mechanical Testing with Load Bank: 11/7/2018 through 12/26/2018
  - Finalizing Utility Interconnection & Utility Witness Testing: Early February 2019
  - Final Co-Gen System Commissioning: Middle of March 2019
  - Anticipated Power Export: End of March 2019
- **Full Power Projection:**
  - With adequate supply of organic food waste, GLSD will produce upwards of 3.2 MW of electricity
  - Power will be used at the WWTP and the off-site Riverside Pump Station through Net Metering offsets to its power bill

# Lessons Learned

- Metering of Food Waste Slurry requires food Industry quality flow metering devices
- Food Waste may have small bone and glass fragments and require pumping systems that have resilient components
- When exporting power to the grid, the utility should be contacted as early in the design process as possible to obtain an Interconnection Agreement and an understanding of the utility requirements
  - Ongoing coordination with the utility and weekly meetings strongly recommended
  - Witness test plans must be submitted and approved prior to exporting power
  - Requires a long process with experts in the field

# GLSD's Organics to Energy Project Highlights

- \$26 M total investment in new facilities
- \$9.8 M in financial assistance (MA DOER, MassDEP, CEC, CWT, National Grid)
- Provides a net economic benefit to the District (Environmental Justice)
- Advances the Recycling of Organics for Massachusetts to meet state goals
- GLSD will become a Net Zero or Net Positive Electric Energy User
- Furthers GLSD's Tradition of Innovation and Goal of Net Zero Operation



# QUESTIONS?

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