Sheboygan Regional WWTF's Biosolids Dewatering & Drying Process Improvements

2016 CSWEA Operations Focus Seminar

May 18, 2016

Sheboygan Regional WWTF

- 7 Communities, Western Shore of Lake Michigan
- Population 68,000
- 18.4 MGD Average, 56.8 MGD Max
- 10 MGD Average Daily Flow
- Activated Sludge with Biological P Removal and Backup Ferric Chloride Addition
- Anaerobic Co-Digestion, Biogas Recovery for Combined Heat & Power
- Liquid Storage of AD Biosolids and Biosolids Drying & Storage
- $4.7 Million O&M Budget
- 2013 ACEC Engineering Excellence Grand Award - Net Zero Energy

Biogas to Energy

2005
Energy conservation initiatives & Co-digestion implemented

2006
Co-digestion program increased biogas

2012
Purchased biogas conditioning equipment and turbines from Alliant Energy - City recoups all cost savings from biogas to energy systems

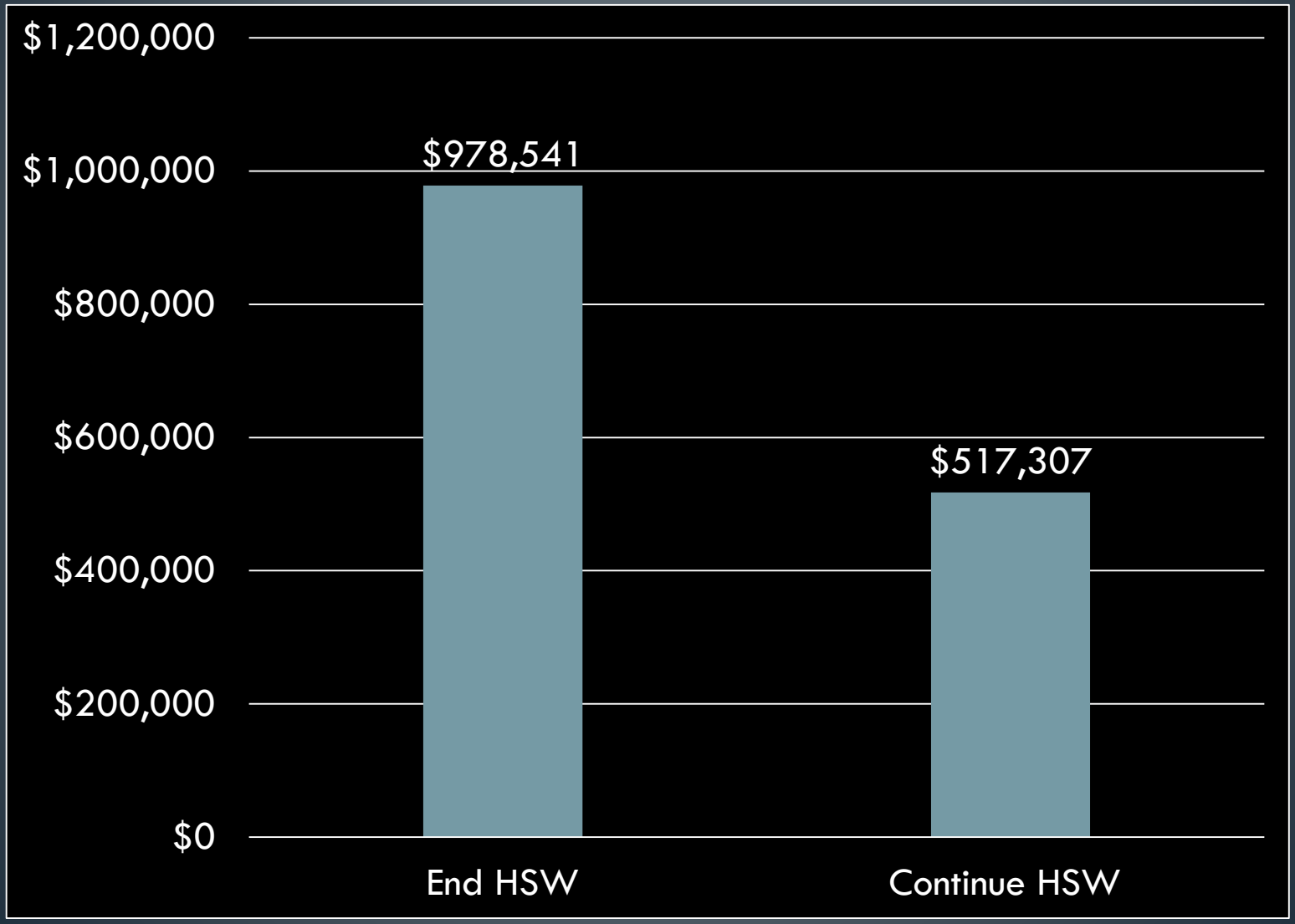
2006
Partnered with Alliant Energy - installed biogas conditioning and turbines;
300 kW, 1MMBtu/hour heat

2010
Installed additional biogas conditioning and turbines;
400 kW,
1.4MMBtu/hour heat

10 Years of HSW & Energy Program

- Process 60,000 gpd High Strength Waste
- Biogas Produced: 500,000 cu ft/day
- Biogas Quality: 53-63% Methane
- Equipment Installed: 700kW Electrical Generation
- Electrical Energy Produced: 5,000,000 kWh Annually
- Thermal Energy Produced: >100,000 Therms Annually
- Energy Savings: >$450,000 Annually; ~80% Electrical & Heat Needs
- Significant Capital Improvements Required
- Increased Biosolids

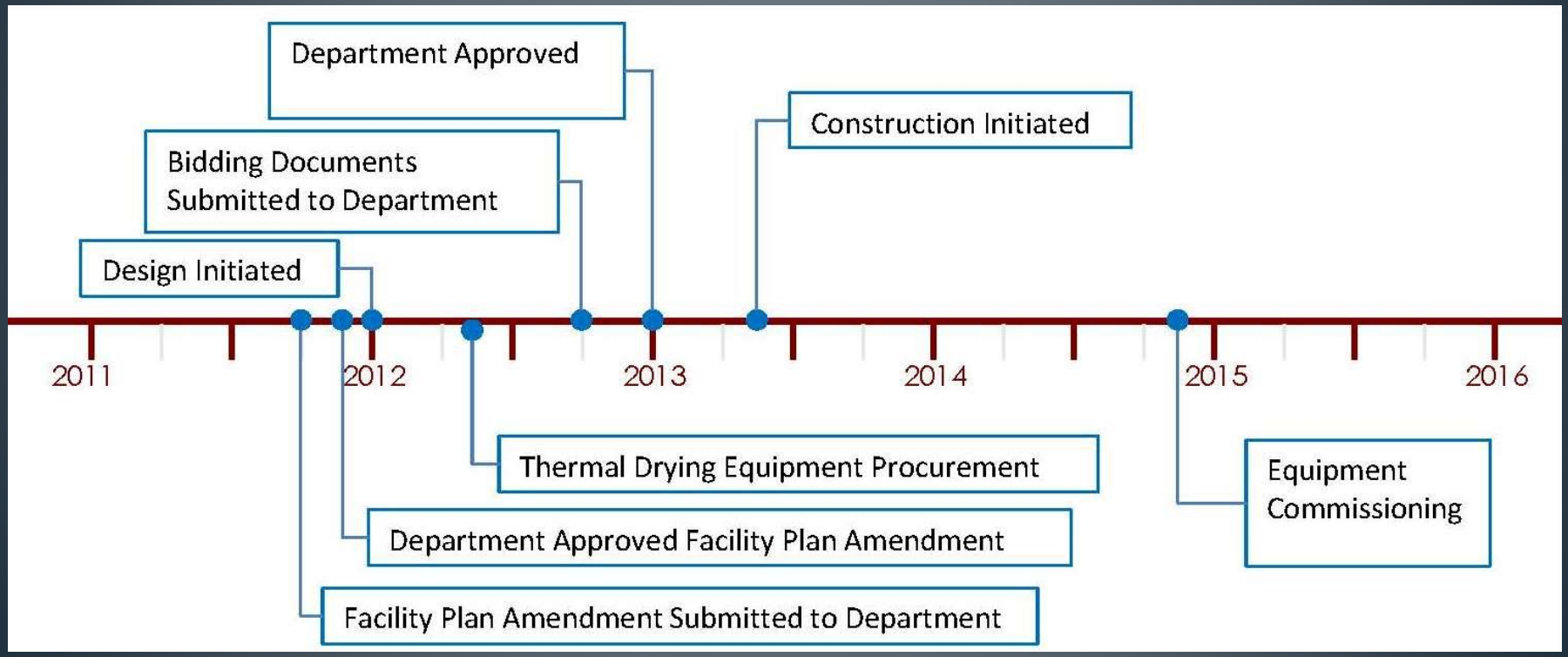
Annual Operating Costs
Energy + Biosolids



Biosolids Storage Requirements

- NR 204 Requires 180 Day Biosolids Storage
- Increase in Biosolids Production Attributable to HSW
- 10.08 MG Required; 5.96 MG Available
- Alternatives Considered to Expand Biosolids Storage Capacity
  - Minimal Additional Liquid Storage & Eliminate HSW Receiving Program
  - Large Scale Liquid Storage
  - Liquid Storage & Drying

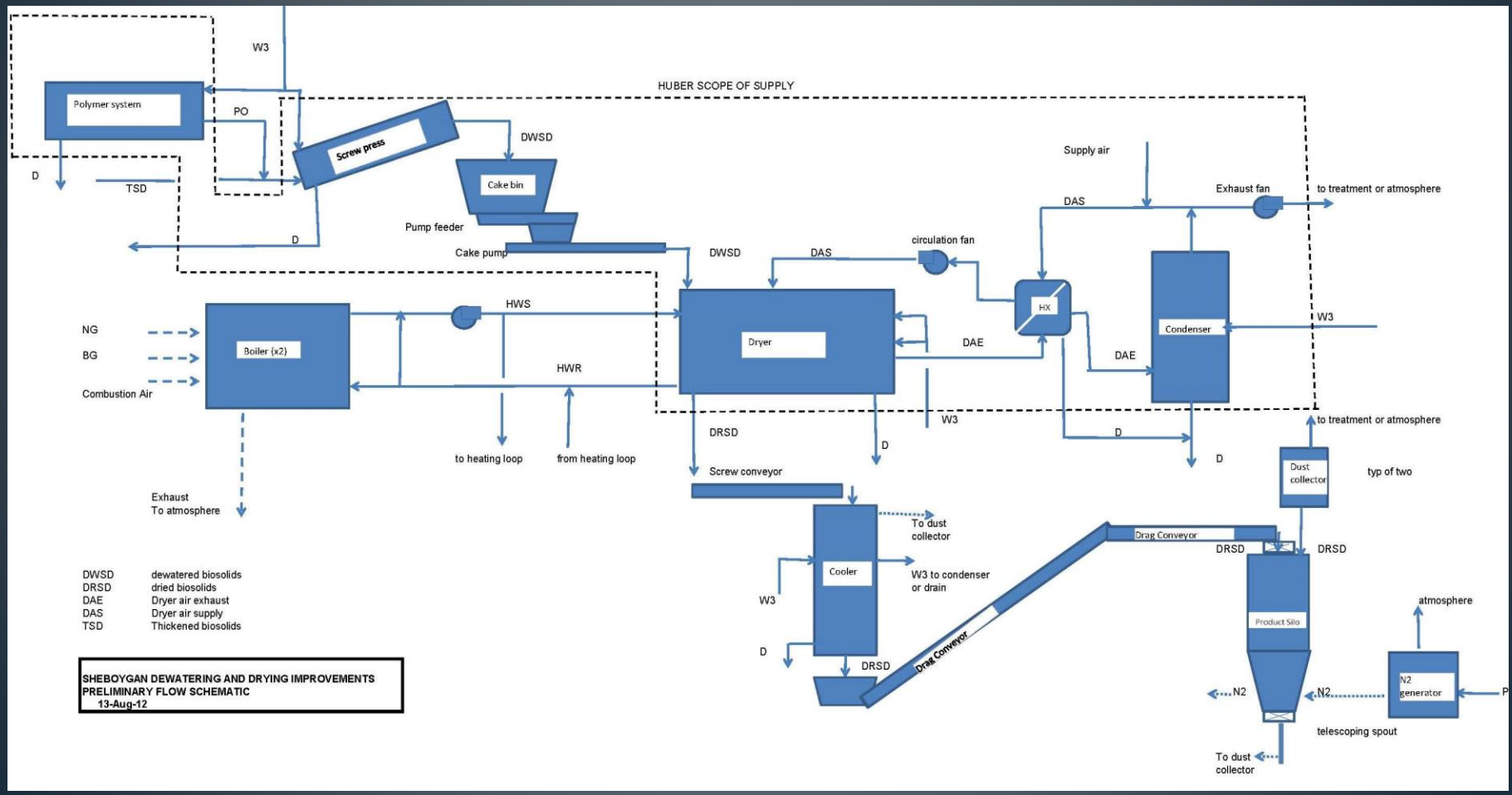
Biosolids Dewatering & Drying Improvements Project Timeline



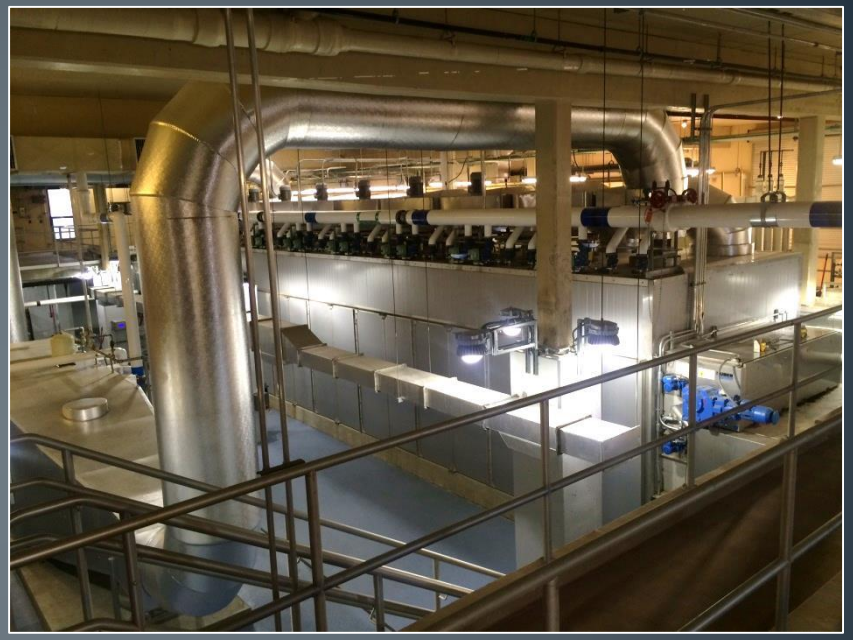
Biosolids Storage Option: Drying

- N-E-W Paradigm
  - Nutrient Recovery
    - Class A, EQ Product
  - Energy Independence
    - Utilize Excess Biogas & Waste Heat
  - Water Reuse
    - Utilize Final Effluent for Process Water
- Reuse Existing Infrastructure
  - Utilize & Rehab/Repurpose Existing Building

Biosolids Dewatering & Drying Improvements Flow Schematic



Biosolids Process Improvements



- Dewatering & Drying: Huber Screw Press & Huber Medium Temperature Belt Dryer
- Dryer Utilizes Excess Biogas & Waste Heat from CHP
- Class A, EQ Product
- Significant Cost Savings (Drying vs Hauling Liquid)

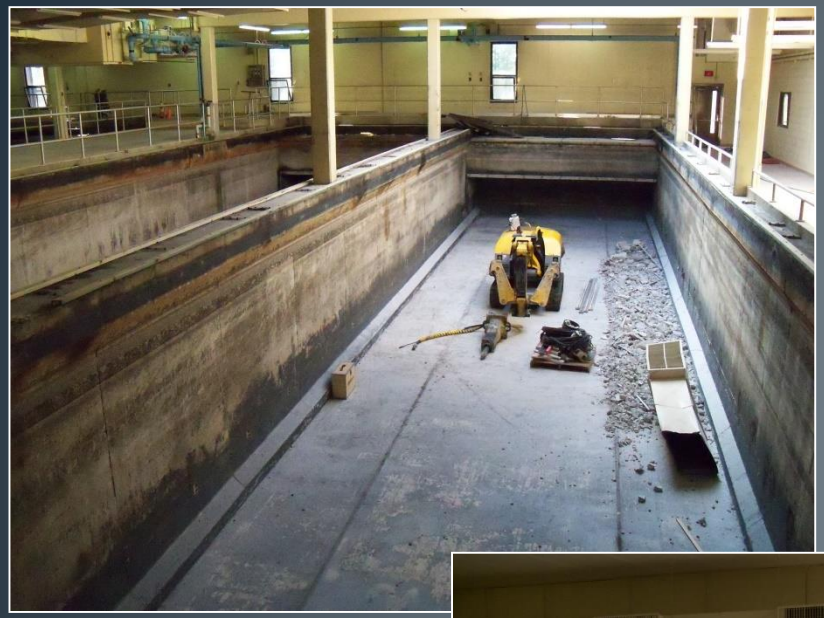
Dewatering & Drying Design Criteria

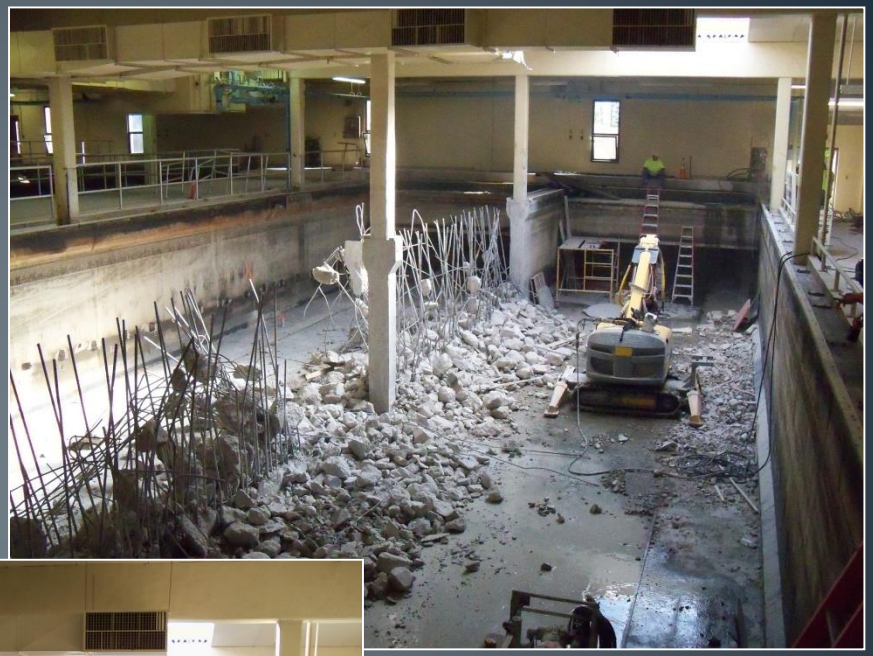
Parameter	Design
Dewatered Sludge Content	22-24% TS
Sludge Amount	11,904 ton/yr
Operation Time	6,000 hr/yr
Sludge Throughput	3968 lb/hr (22% TS)
Water Evaporation	3000 lb H_2O/hr
Dried Biosolids Solid Content	90% TS
Dried Biosolids Produced	~2600 tons/yr (dry wt)
Heat Transfer Medium	194 deg F H_2O @ 220 gpm

Biosolids Dewatering & Drying Improvements Project Costs

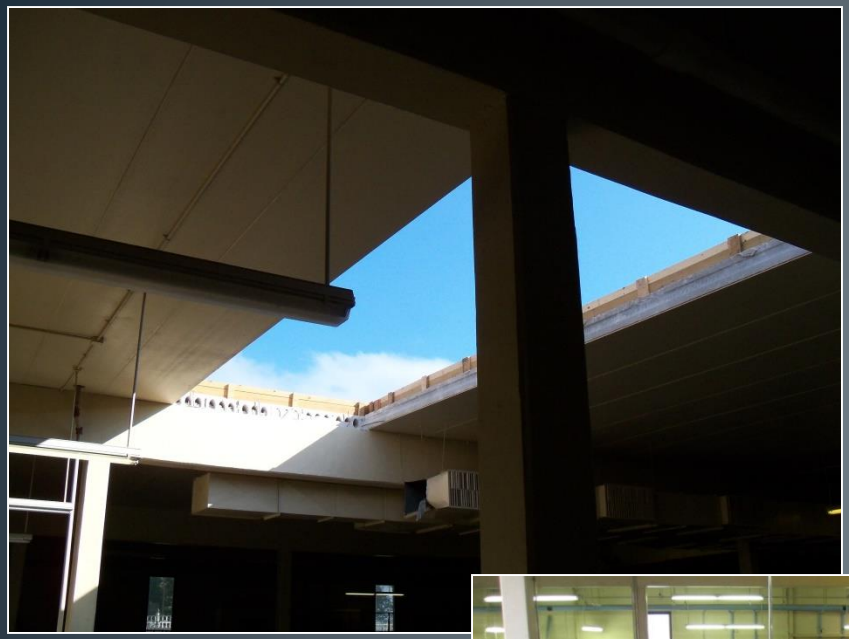
- Huber Belt Dryer BT18 = $2.5 Million
- Huber Q800 Screw Press = $0.324 Million
- Total Project Cost = $8.0 Million
- Clean Water Fund Program Loan
- Anticipated Increase in O&M Costs = $60,000/year
- Projected Savings (Hauling Costs) = $100,000 – 200,000/year
- Huber Designed Solids Dewatering & Drying Systems & Associated Equipment
- Donohue & Associates, Inc. Designed Balance of Plant to Support Dewatering & Drying Systems
- General Contractor Assigned Thermal Drying Equipment Procurement Contract
  - Responsible for All Equipment Procurement & Installation; All Warranties

Construction: Repurposing Existing Building



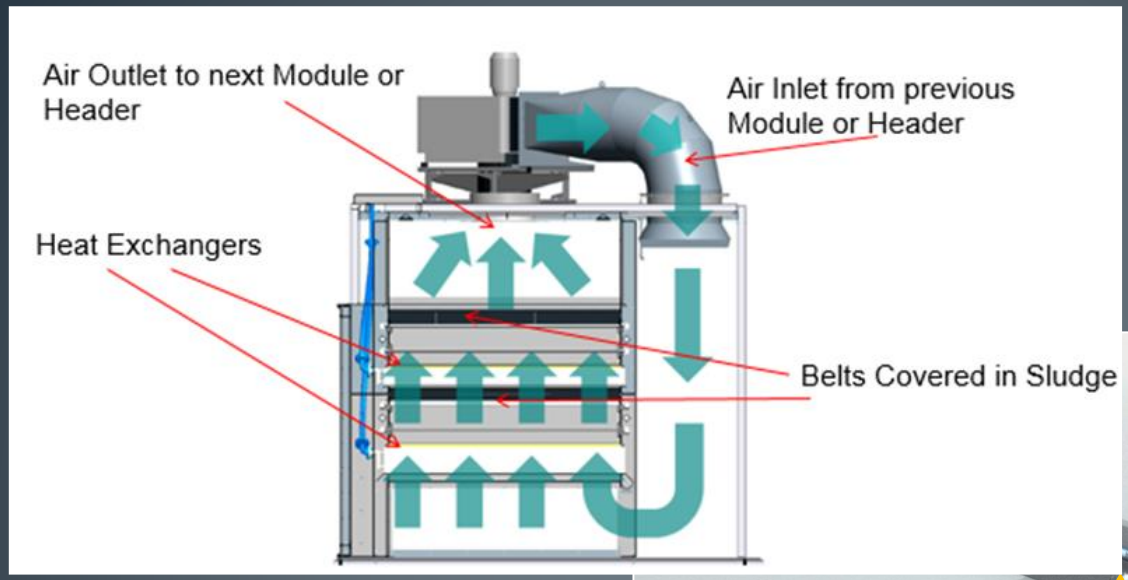


Construction: Repurposing Existing Building

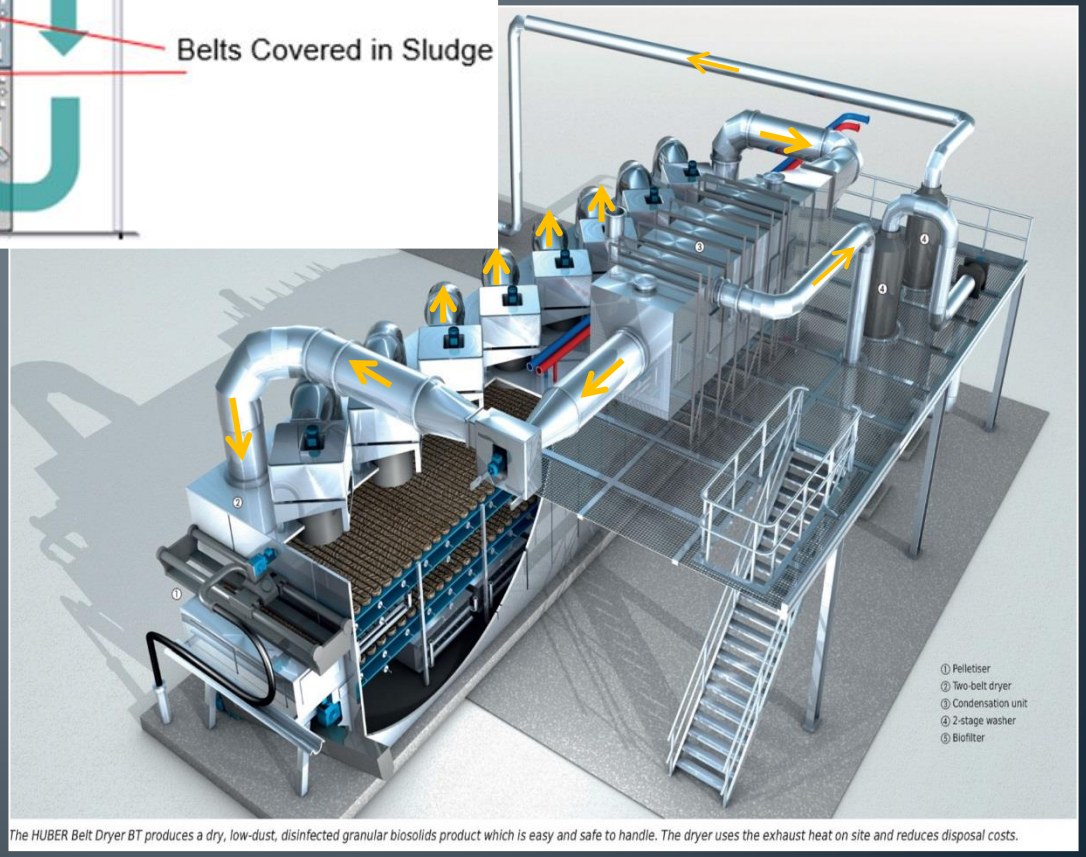


Huber Belt Dryer: Modular Installation

Huber Belt Dryer: Design



- Air Flow
  - Helical Flow Pattern
  - From Rear
- Negative Pressure
- Heat Reclaimed
- Moisture Condensed

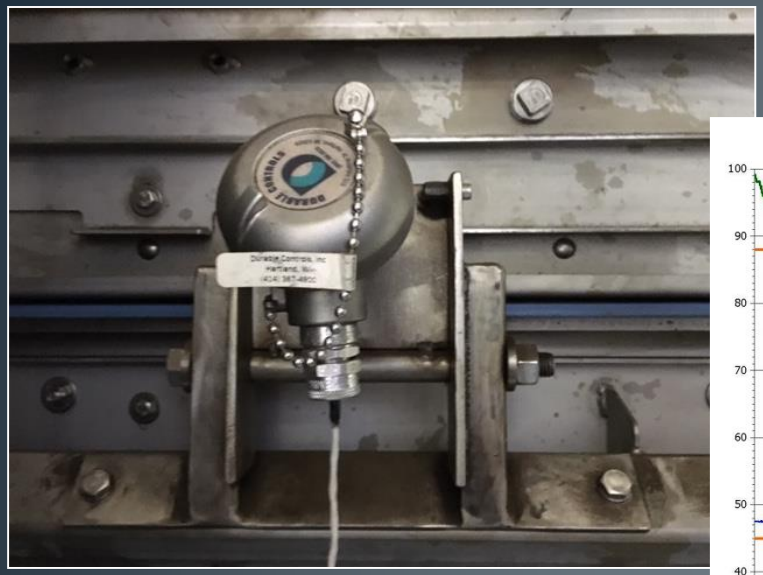


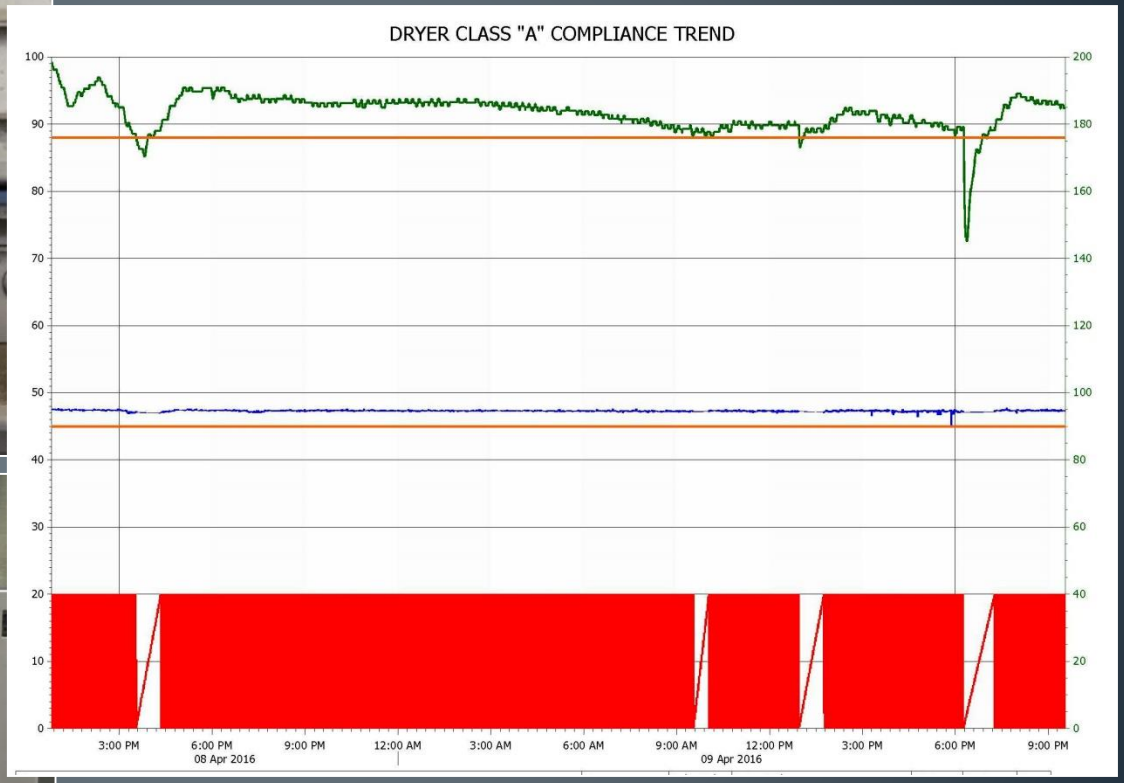
The HUBER Belt Dryer BT produces a dry, low-dust, disinfected granular biosolids product which is easy and safe to handle. The dryer uses the exhaust heat on site and reduces disposal costs.

Huber Belt Dryer: Design

Extruder with Rotating Knife

Class A Certification





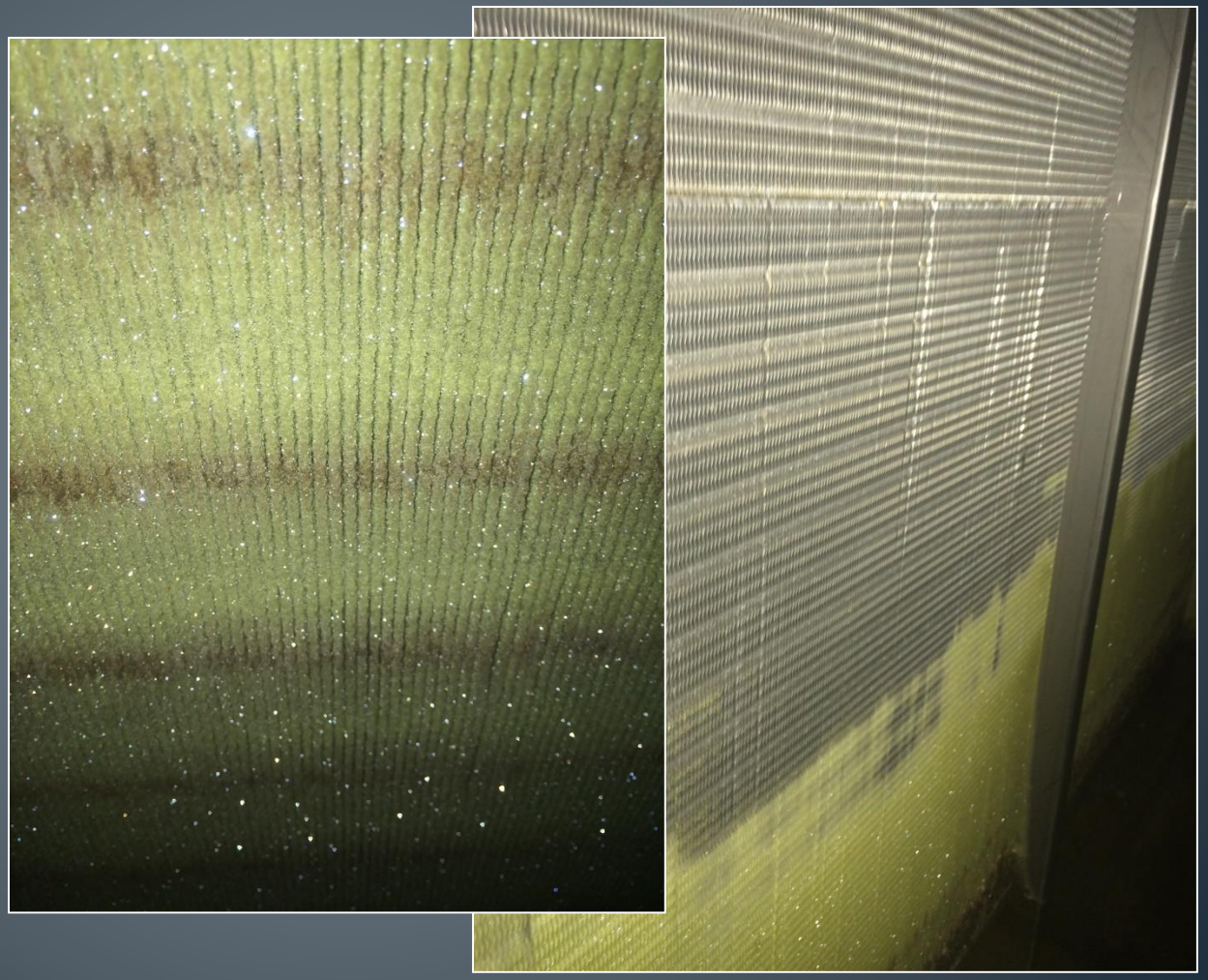
Nutrient Recovery: Class A, EQ Biosolids

Operational Challenges: Dewatering

- High Polymer Consumption
- Inconsistent Operation

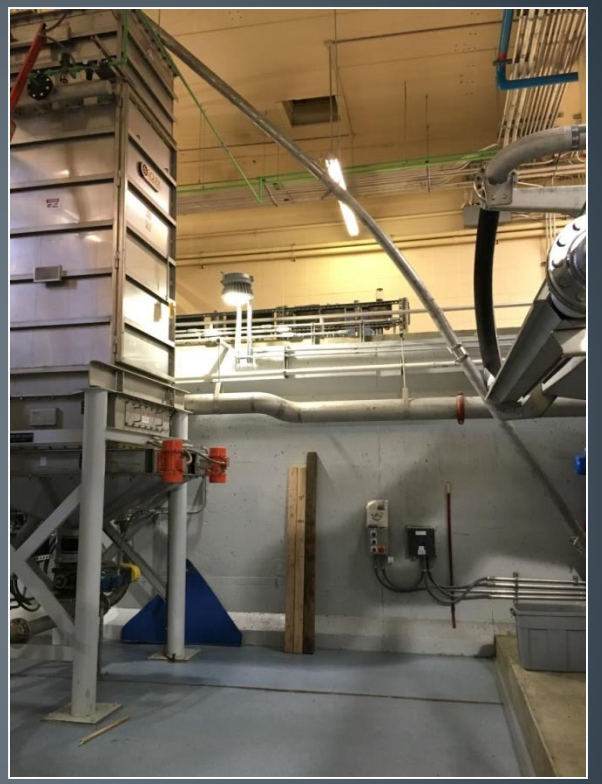
Operational Challenges: Condenser

- Elemental Sulfur Deposits
- Pilot - Wet Scrubber Condenser



Lessons Learned

- Cooler - Not Required
- Level Sensors – Proper Selection
- Dewatering - Polymer Criteria
- Sludge Cake Hopper – Design
- PATIENCE & PERSERVERANCE



Continuing to Reclaim Nutrients

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