



**Water Environment Association**  
Preserving & Enhancing Ohio's Water Environment



# Press or Spin? Dewatering Case Studies

**OWEA State Conference**  
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**June 22, 2011**

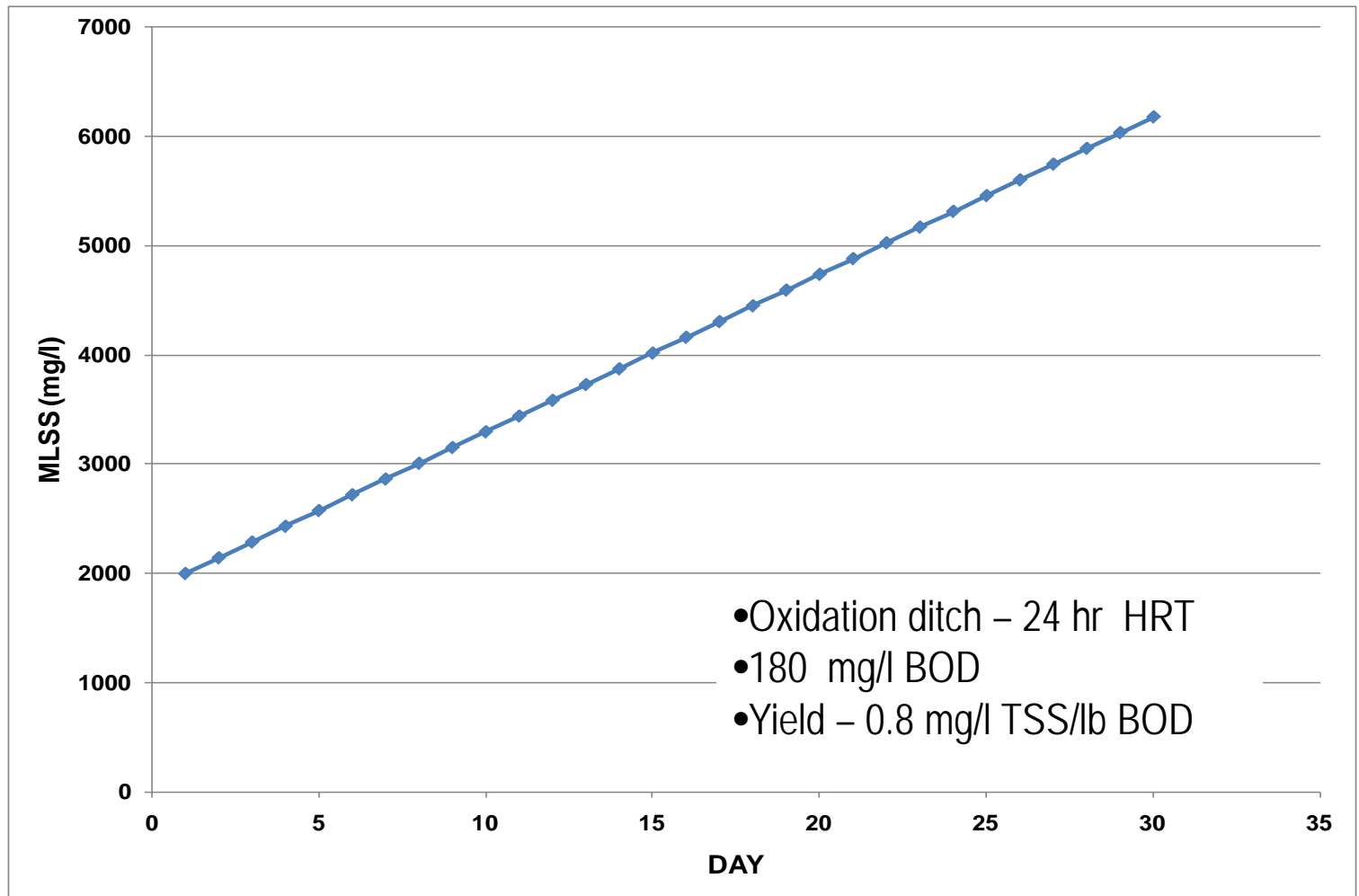


**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

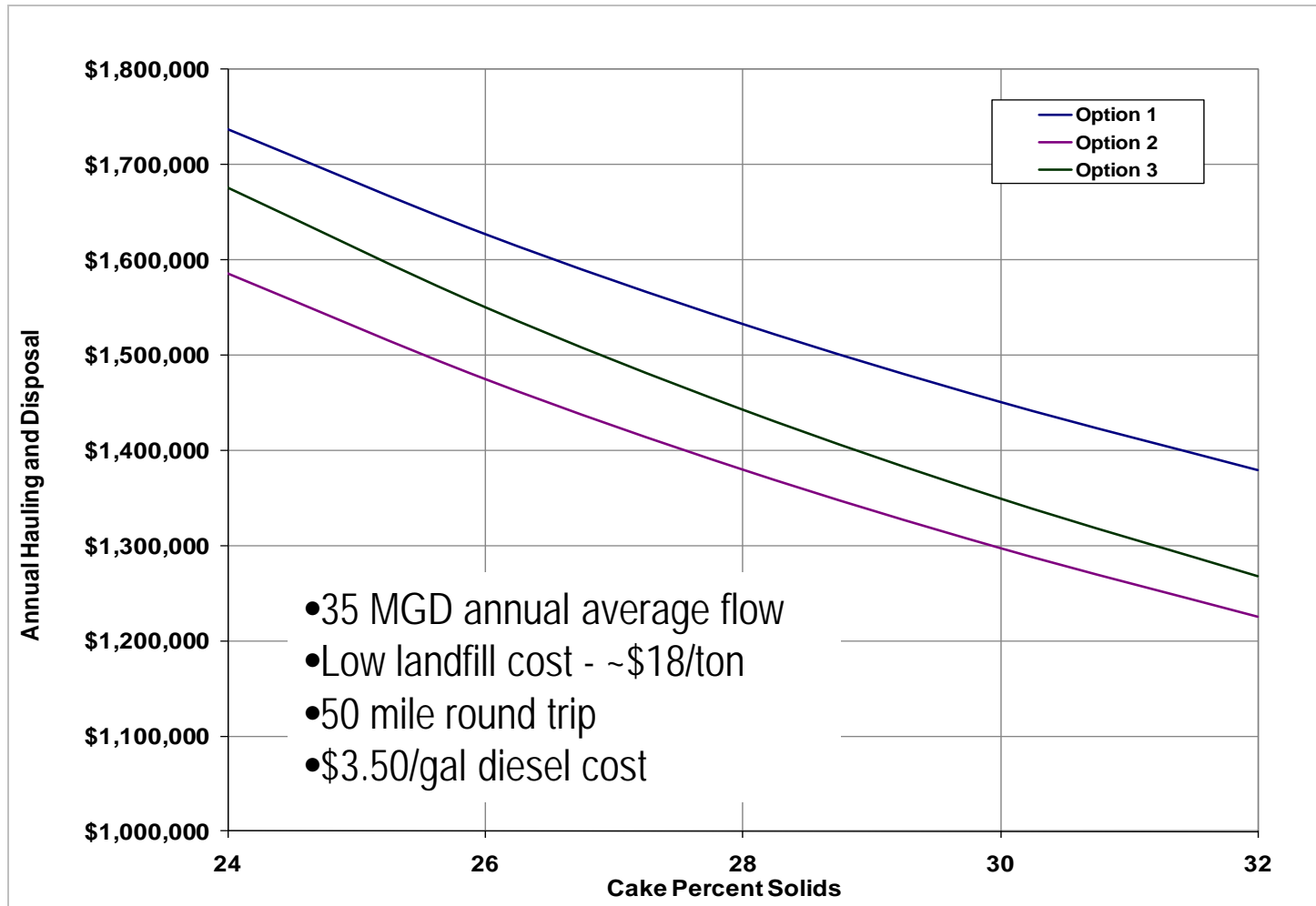
# Presentation Overview

- A Reminder of Importance
- Factors for Consideration
- Case 1: Plate vs Belt or Centrifuge
- Case 2: Belt vs Rotary or Screw
- Wrap Up

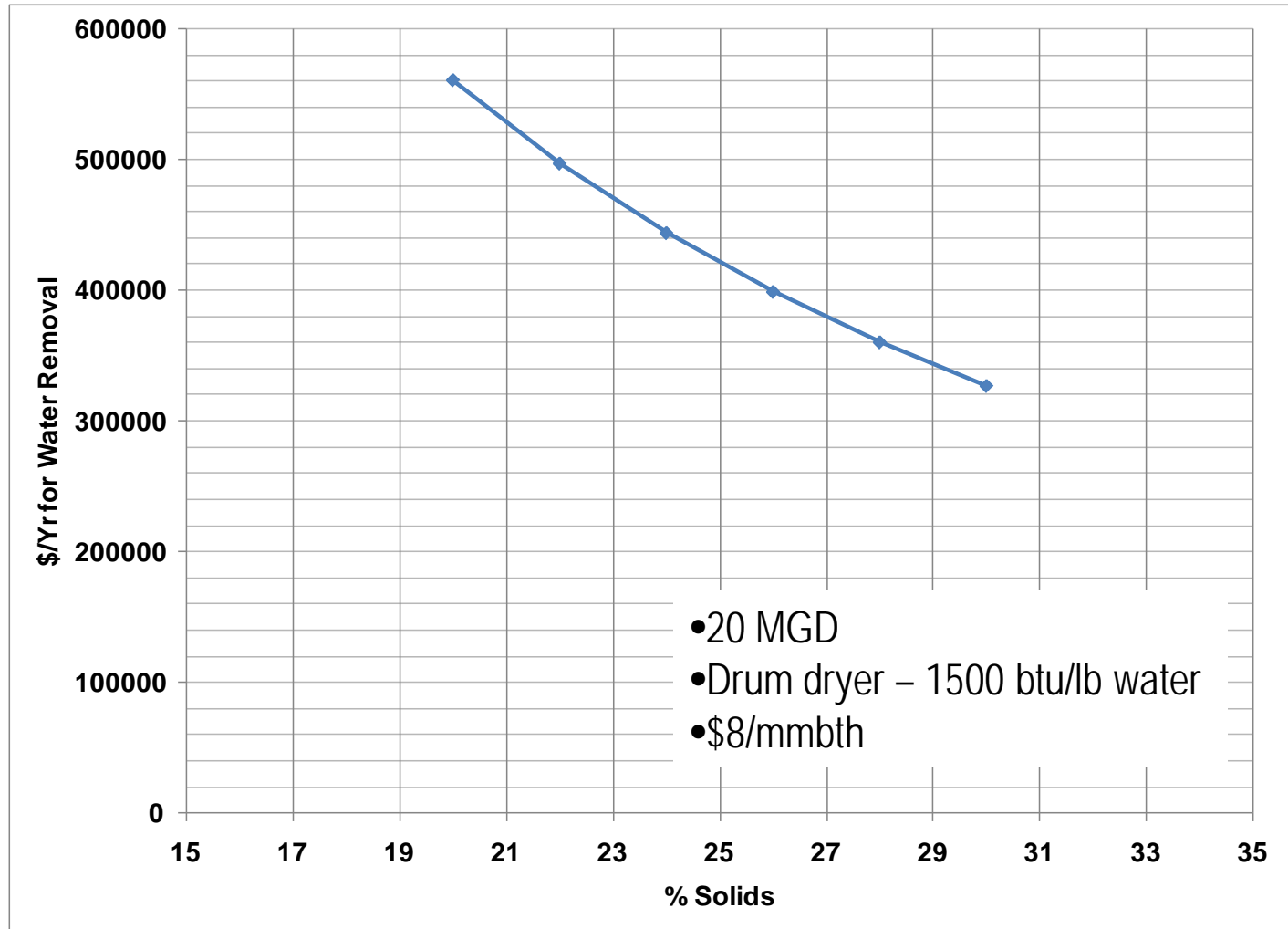
# If you can't treat solids.....



# Disposal

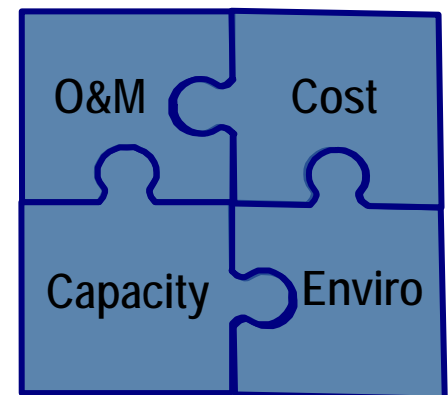


# Downstream?....Drying



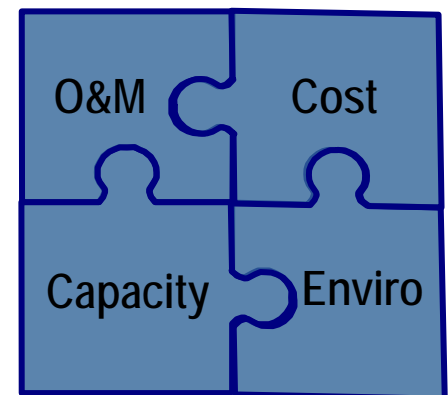
# Dewatering Considerations

- Require relatively large capital investment
  - Site constraints / available space
- Substantial share of annual O&M budget
  - Chemical addition
  - Wash water
  - Electricity
  - Labor

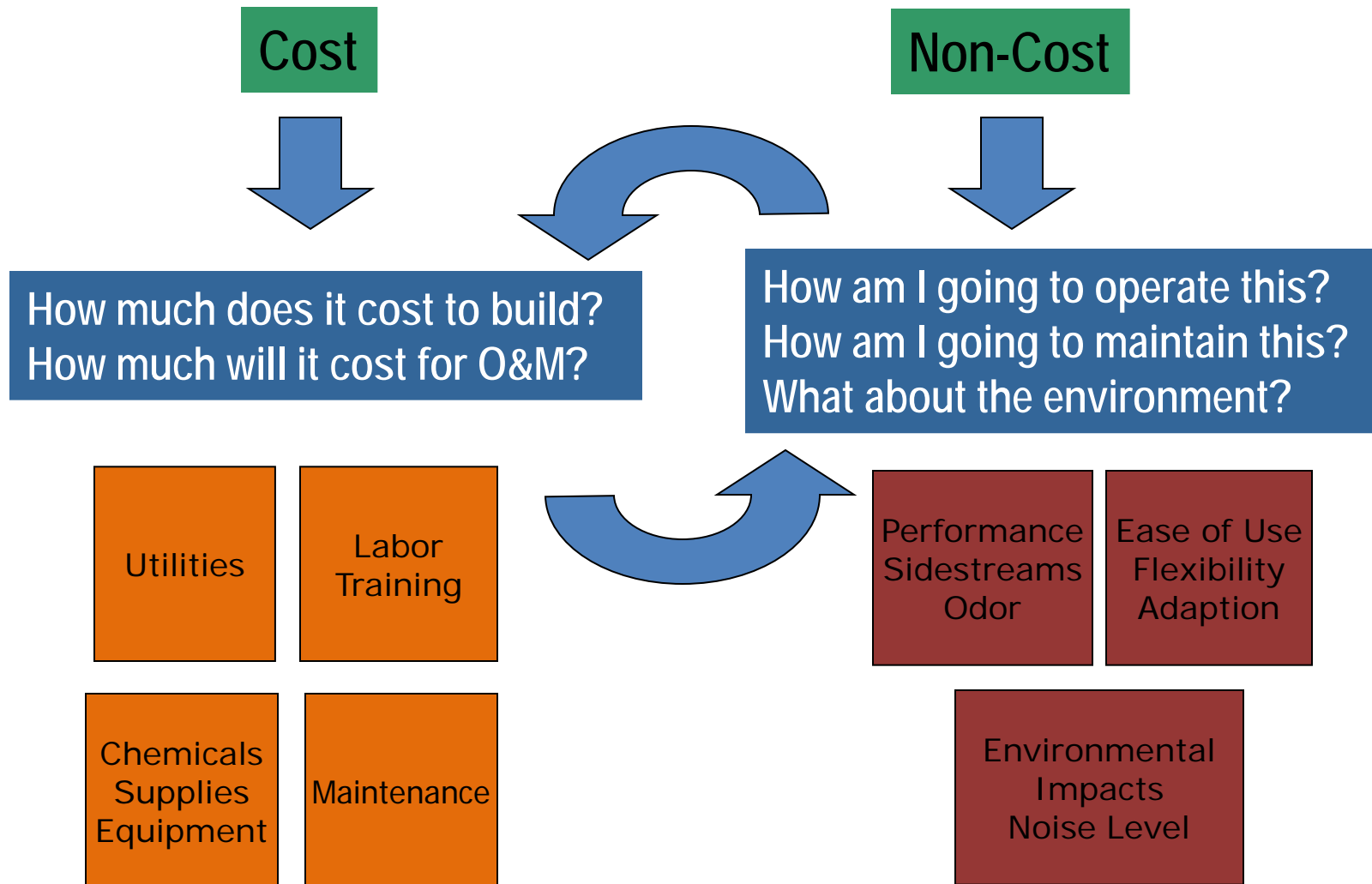


# Dewatering Considerations

- Dewaterability (sludge characteristics)
- Consider impacts on treatment train
  - Sidestream treatment
  - Odor control
  - Future capacity / adaptability
- End-use
  - Further treatment
  - Disposal requirements



# Different Viewpoints



# Dewatering Technologies

Thickening

Centrifuges

GBTs

Gravity  
Thickeners

Stabilization

Aerobic Digestion

Anaerobic Digestion

ATAD

TPAD

Dewatering

Plate Filter Press

Centrifuges

Belt Filter Press

Rotary Press

Screw Press

Post  
Treatment

Microwave Drying

Conventional Drying

Composting

Lime Stabilization

Incineration

# Case 1: Plate vs Belt or Centrifuge

- 25 MGD plant
- Previously 5 plate and frame presses
- Previous solids operations
  - Lime and ferric pretreatment
  - Lime stabilized (Class A) after dewatering
  - Land application – haul/give to local farmers
- New solids operations
  - No stabilization (blended primary + WAS)
  - Landfill disposal

# Previous Processing Equipment

	connected hp	Number	total hp
Grinder Pumps	3	2	6
Mixer Pit	1.5	1	1.5
Odor control	2	2	4
Lime feed tank mixer	15	1	15
Silo screw conveyor	5	1	5
Transfer screw conveyor	5	1	5
Lime Hose Pump	10	3	30
Ferric Pump	2	1	2
RDP Sludge Storage Mixer	1	2	2
Press Feed Pumps	25	5	125
Air Compressor	30	2	60
Drag chain conveyor	25	5	125
Transfer Screws	25	5	125
Sludge Lime Mixers	25	3	75
Pug mill	25	3	75
Cross Belt Plow	15	2	30
Cross Conveyors	5	2	10
Intermediate Conveyor	5	2	10
Shuttle Conveyor	2	2	4
Shuttle Trolley	2	2	4
Vibrator	1.32	3	3.96
Long sweep conveyor	25	2	<u>50</u>

<b>total hp</b>	<b>767.5</b>
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# Previous Processing Cost

## Power:

total hp hrs	37,323
hp/kw	1.34
\$/kwhr	\$0.08
<b>total power cost</b>	<b>\$2,152\$/week</b>

## Chemistry:

Lime Feed	Pressings/wk	lbs/pressing	
Lime Feed (1,000 lbs for Press)	51	1,000	51,000 <i>lb/week</i>
Lime Feed (1,200 lbs for Class A)	51	1,200	<u>61,200</u> <i>lb/week</i>
		total lime	112,200 <i>lb/week</i>
	Lime Cost/ton		<u>\$168</u> \$/ton
		<b>lime cost</b>	<b>\$9,425\$/week</b>
Ferric Chloride (100 gals/press')	51	100	5,100 <i>gallons</i>
Ferric Chloride Cost/lb			\$0.127
Ferric Chloride Specific Gravity			<u>1.41</u>
		<b>ferric cost</b>	<b>\$7,617\$/week</b>

# Previous Processing Cost (Cont.)

## Labor:

Operating hours/week for staffing	55 hrs	
Press Room Operators	2	
Control Room Operator (Pug mill)	1	
Truck and Front Loader	0.5	
	192.5 manhours/wk	
	\$15.50 hourly rate	
	1.42 benefits rate	
	<b>total labor cost</b>	<b>\$4,237 \$/week</b>

## Maintenance and Disposal Costs: **\$2,000 \$/week**

- Significant annual costs:
  - Drag chain conveyors at \$140,000 per unit.
  - New plate and frame press @ \$1.3M installed
  - Chemical feed, smaller conveyance systems, high pressure pumping all contributed to significant maintenance costs

# New Equipment Parameters

- Belt Filter Press (2m)
  - Max hydraulic loading = 200 gpm
  - Max solids loading = 2220 lb/hr
  - Typical Avg Cake Solids = 21%
- Centrifuge (21" bowl)
  - Max hydraulic loading = 300 gpm
  - Max solids loading = 3330 lb/hr
  - Typical Avg Cake Solids = 25%

# New Processing Equipment

Two Presses	connected hp	Number	total hp
Drive	5	2	10
Wash water	15	2	30
Gravity Section	2	2	4
Feedbox	0.5	2	1
Hydraulic System	3	2	6
Feed pump	20	2	<u>40</u>
		total hp	91

- Fraction of previous
  - Over 700 hp



# New Processing Cost

## Power:

total hrs/wk	66
total hp hrs	6,006
hp/kw	1.34
\$/kwhr	\$0.08
total power	<b>\$346\$/week</b>

## Chemistry:

emulsion polymer cost	\$0.90/lb
activity	0.36
assume 7 lbs active polymer / dt	7lbs/dry ton
* high charge, high wt, large branch	
Polymer usage / dry ton	\$17.50 cost/dry ton
emulsion polymer cost/day	\$329.50 cost/day
Polymer cost	<b>\$1,648\$/week</b>

# New Processing Cost (Cont.)

## Labor:

Press Room Operators	1
Operator for Loading	0.5
	99manhours/wk
	\$15.50hourly rate
	1.42benefits rate
Total labor	<b>\$2,179\$/week</b>

## Maintenance and Transportation Costs: **\$3,423 \$/week**

- Significant annual costs:
  - Example is landfill transportation and tipping fee (next slide)
  - In comparison, minimal maintenance anticipated

# New Processing Cost (Cont.)

## Projected Cost of Operation (landfill disposal)

Dumpster Charge (tipping and transportation)	\$194.40	30 cyd dumpster
Projected primary and waste sludge cake	22.0%	
Projected dry lbs (primary & secondary)	37,657	dry lbs/day
Projected wet lbs (primary & secondary) cake	171,170	wet lbs/day
Cake solids weight/cf	60	lbs/cf
Projected Wet Volume to disposal	2,853	cf/day
Projected Wet Volume to disposal	106	cyd/day
dumpster volume	30	cy
dumpsters/day	3.5	
disposal cost at landfill	<b>\$3,402</b>	<b>\$/week</b>

# Processing Cost Comparison

## Plate and Frame/Class A versus Belt Press/Class B

	P&F/Class A	BP/Class B
Dewatering		
Power	\$2,152	\$346
Chemistry	\$17,041	\$1,648
Labor	\$4,237	\$2,179
Maintenance/Disposal	<u>\$2,000</u>	<u>\$3,423</u>
<i>total weekly cost</i>	<b>\$25,430</b>	<b>\$7,596</b>
<i>total annual cost</i>	<b>\$1,322,360</b>	<b>\$394,992</b>

- Replace plate and frame presses
- Move to Class B operations

# New Equipment Comparison

	Belt Filter Press	Centrifuge	
	5 x 15	5 x 15	5 x 15
Total Present Worth	\$14.8M	\$15.6M	\$14.7M
Average Annual Cost	\$1.53M	\$1.63M	\$1.51M

- 10 year present worth
- Present worth cost overlap
- Increase importance of non cost factors

3330 lb/hr

2220 lb/hr

# BFP vs Centrifuge

Belt Filter Press	Centrifuge
Slightly lower capital cost	Smaller / lighter equipment
Less power	Greater capacity is possible
Typically slightly less polymer	Less odors / splashing
Lower maintenance cost	Lower disposal costs (higher cake solids)
Will require longer oper hours, digestion, or bldg expansion	Slightly lower O&M and NPW costs
Can view dewatering on belt	

- Full scale pilot units are still under evaluation

# Case 2: Belt vs Screw or Rotary

- Previous solids operations
  - Oxidation ditch to aerobic digestion
  - Contracted belt press dewatering
  - Contracted storage and land application
- New solids operations
  - Oxidation ditch to aerobic digestion
  - Onsite dewatering
  - Contracted storage and land application

# Design Criteria

	1.3 MGD Current	4.0 MGD Future
Feed Solids Concentrations (TS)	2%	2%
Dewatered Solids (TS)	15%	15%
Percent Solids Capture (TS)	95%	95%
Volume (gallons / minute)	65	80
Mass Loading (dry lbs TS / hour)	660	810

- 25 year present worth comparison
  - Contracted belt press
  - Onsite rotary press
  - Onsite screw press

# Factors for Comparisons

- **Contracted Belt Press**

Advantages	Disadvantages
<ul style="list-style-type: none"><li>● Current Operation / familiarity</li><li>● On-call operation</li><li>● No Capital / Maintenance</li></ul>	<ul style="list-style-type: none"><li>● Cost for contract</li><li>● Equipment Lead Times</li></ul>

- **Onsite Screw or Rotary Press**

Advantages	Disadvantages
<ul style="list-style-type: none"><li>● Small Footprint</li><li>● Lower Utility Cost</li><li>● Lower Capital Cost</li><li>● Lower Maintenance</li></ul>	<ul style="list-style-type: none"><li>● In-house labor requirements</li><li>● Pilot to Verify Performance</li></ul>

# Contracted Belt Press

- On-call mobile service
- \$0.03 / gallon
- Only increase for cost of inflation
- No capital cost
- No maintenance cost
- No labor cost

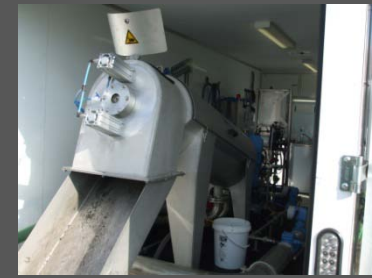


# Rotary Press



Consumables/Fees	Cost
Polymer Use	15 active pounds / dry ton
Normal Connected HP	7 HP
Hours of Maintenance / Day	1 hr / day
Days of Operation / Week	2 Days (Current) / 5 Days (Future)
Labor Rate for Operation	\$36.00 / hr
Hours a Week for Labor	2 hrs (Current) / 5 hrs (Future)
Yearly Increase in Labor and Chemicals	2%
Maintenance Cost (% of Capital Cost)	2%

# Screw Press



Consumables/Fees	Cost
Polymer Use	15 active pounds / dry ton
Normal Connected HP	13 HP
Hours of Maintenance / Day	1 hr / day
Days of Operation / Week	2 Days (Current) / 5 Days (Future)
Labor Rate for Operation	\$36.00 / hr
Hours a Week for Labor	4 hrs (Current) / 10 hrs (Future)
Yearly Increase in Labor and Chemicals	2%
Maintenance Cost (% of Capital Cost)	2%

# Present Worth Summary

Dewatering Alternatives	Capital Present Worth (\$MM)	Average Annual O&M Cost	O&M Present Worth (\$MM)	Total Present Worth (\$MM)
Contracted Press	\$0.00	\$186,000	\$2.25	\$2.25
Rotary Press	\$1.19	\$57,000	\$0.74	\$1.93
Screw Press	\$2.22	\$92,000	\$1.21	\$3.43

- Cost evaluation solely would recommend rotary
- Pilot testing was performed for rotary and screw

# Pilot Results

	Rotary Press	Screw Press
Cake Solids, %	13%	19%
Power Consumption, HP	7	10
Equipment Capital Cost	\$300,000	\$408,000
Polymer Usage, Active lbs / Dry Ton	11	19
Installation Cost	\$950,000	\$1,160,000
O&M Cost / Year	\$63,500	\$61,100
Solids Capacity, Dry PPH	400	900
Hydraulic Capacity, gpm	80	90

- Pilot updated assumptions from PW study
- Owner allowed more automation
- Increased hours of operation (unmanned)

# Pilot Results (Cont.)

- Screw press selected
- Owner's comfort level
- Benefits
  - Fewer units to maintain
  - Unmanned operation
  - Drier cake solids
  - Higher unit capacity
  - Operations flexibility for current and future



# Summary and Wrap-up

- Effective dewatering is critical to any downstream processing
- Considerations for dewatering
  - Includes responsibility to rate payers
  - Ownership throughout utility
  - Pilot testing proves capability
- Press or Spin?
  - Owner and site specifics rule the day
  - Team decision considers the pros and cons



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