Water Environment Association
Preserving & Enhancing Ohio's Water Environment

Press or Spin? Dewatering Case Studies

OWEA State Conference
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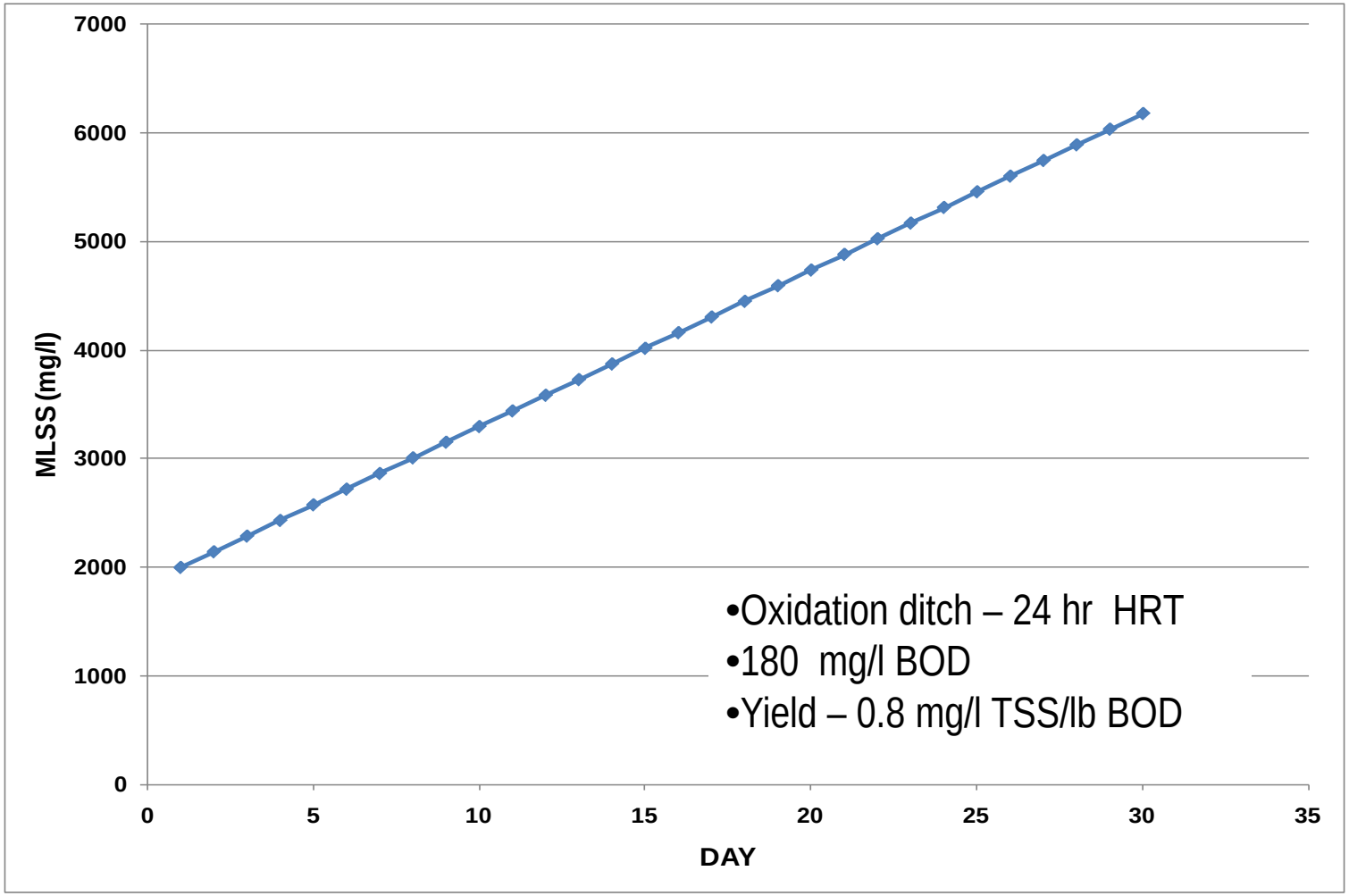
Environmental Engineers & Scientists

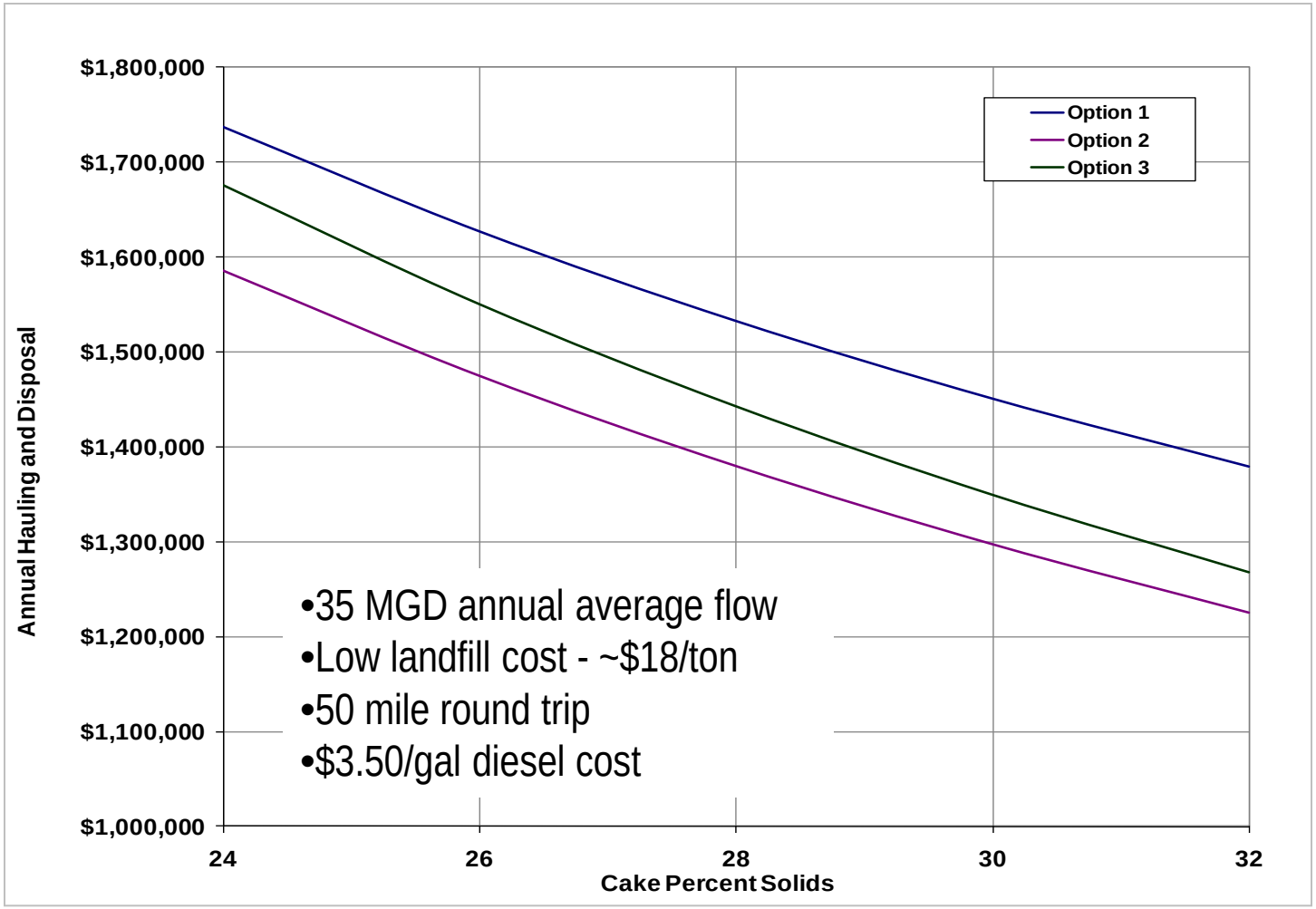
Presentation Overview

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

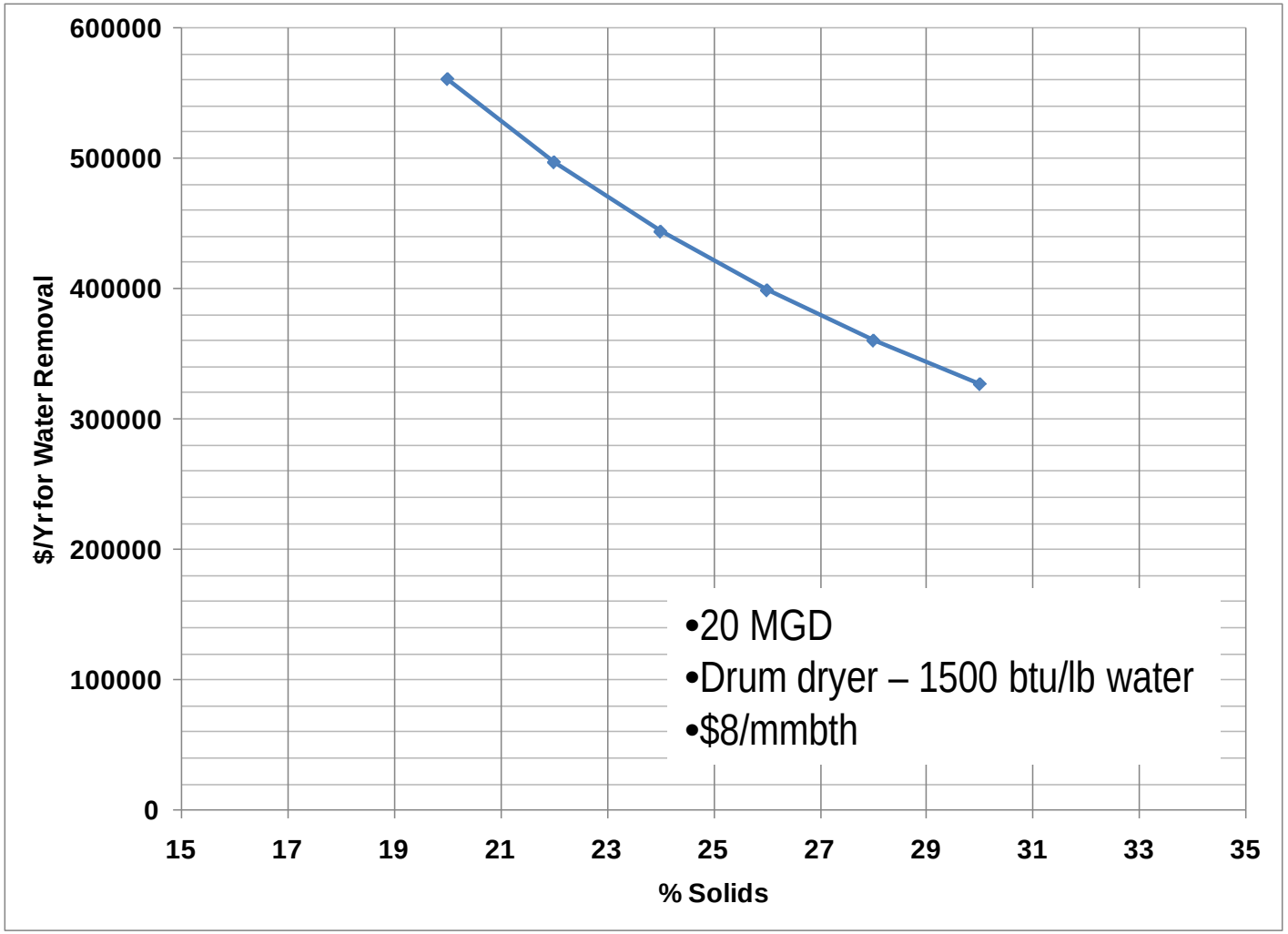
If you can't treat solids…….



Disposal

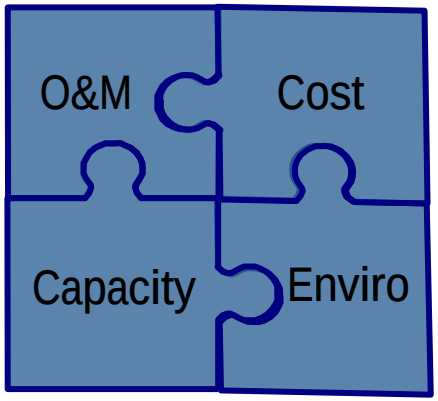

$1,800,000
$1,700,000
$1,600,000
$1,500,000
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
Annual Hauling and Disposal
24
26
28
30
32
Cake Percent Solids
Option 1
Option 2
Option 3
•35 MGD annual average flow
•Low landfill cost - ~$18/ton
•50 mile round trip
•$3.50/gal diesel cost

Downstream?....Drying



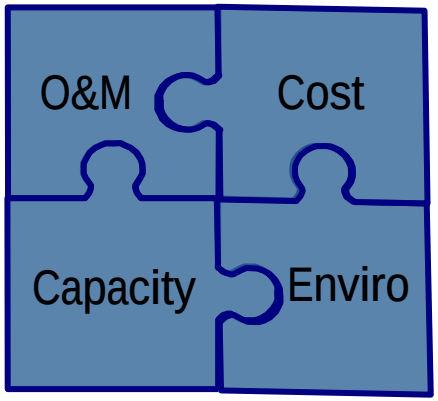
Dewatering Considerations

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

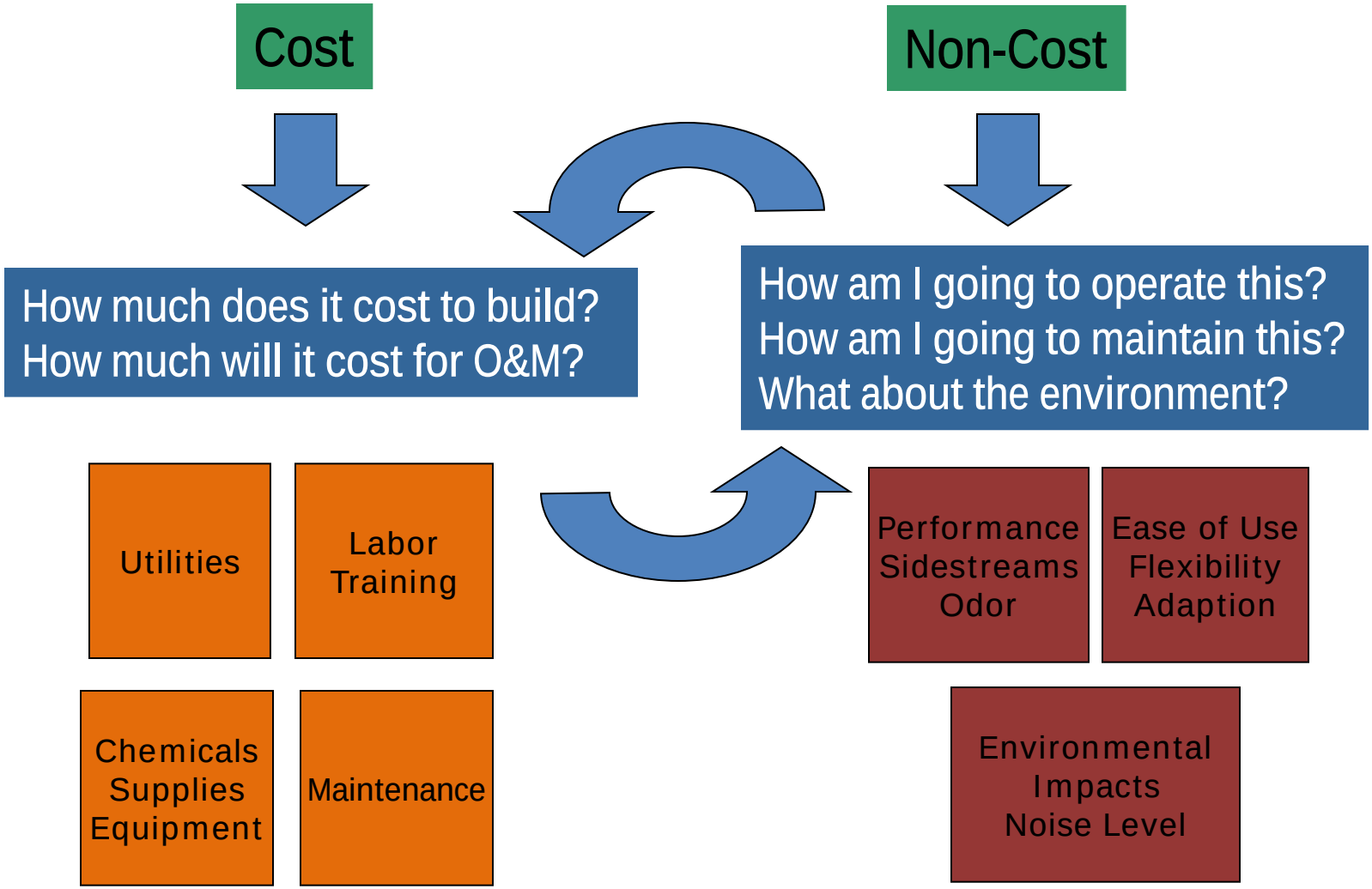


Dewatering Considerations

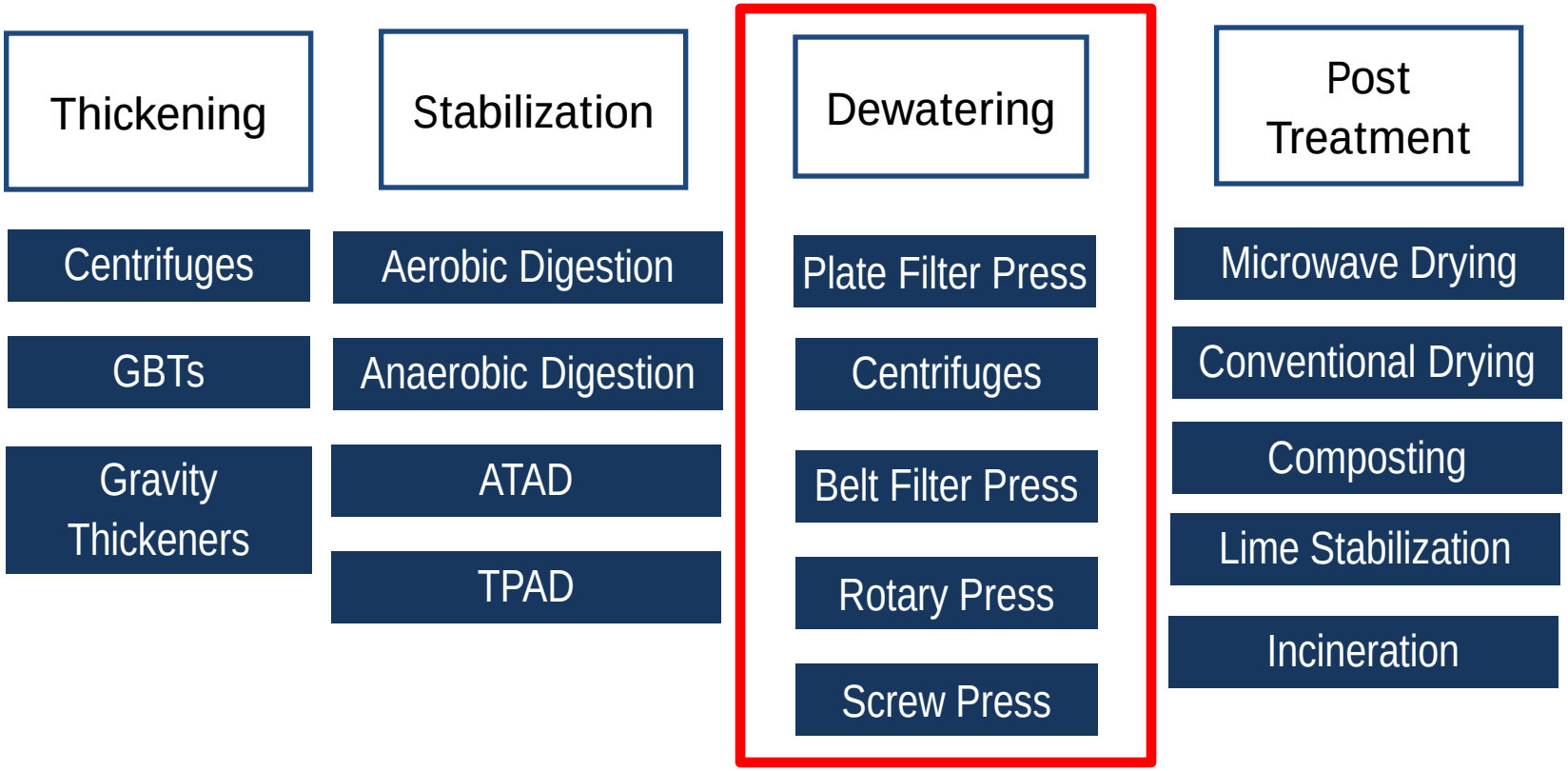
- Dewaterability (sludge characteristics)
- Consider impacts on treatment train
  - Sidestream treatment
  - Odor control
  - Future capacity / adaptability
- End-use
  - Further treatment
  - Disposal requirements



Different Viewpoints



Dewatering Technologies



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	50
		total hp	**767.5**

Previous Processing Cost

Power:

total hp hrs	37,323	
hp/kw	1.34	
$/kwhr	$0.08	
total power cost	**$2,152**	***$/week***

Chemistry:

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

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
	total labor cost	**$4,237 *$/week***

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	40
		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	***$346 $/week***

Chemistry:

emulsion polymer cost	$0.90	lb
activity	0.36	
assume 7 lbs active polymer / dt	7	lbs/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 ***$1,648 $/week***

New Processing Cost (Cont.)

Labor:

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

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	**$3,402**	**$/week**

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	$2,000	$3,423
total weekly cost	**$25,430**	**$7,596**
total annual cost	**$1,322,360**	**$394,992**

- 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

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
• Current Operation / familiarity • On-call operation • No Capital / Maintenance	• Cost for contract • Equipment Lead Times

- Onsite Screw or Rotary Press

Advantages	Disadvantages
• Small Footprint • Lower Utility Cost • Lower Capital Cost • Lower Maintenance	• In-house labor requirements • Pilot to Verify Performance

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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