Dewatering Equipment Selection

Squeezing the Most Out of Your Decision for Municipal Solids Handling

Dewatering Selection

Why dewater anyway?

"21,594 Publicly Operated Treatment Works (POTW's) provide wastewater collection, treatment and disposal service to 226.4 million people in the U.S.

POTWs generate over 8 million dry tons of sludge annually."

-University of Michigan Center for Sustainability

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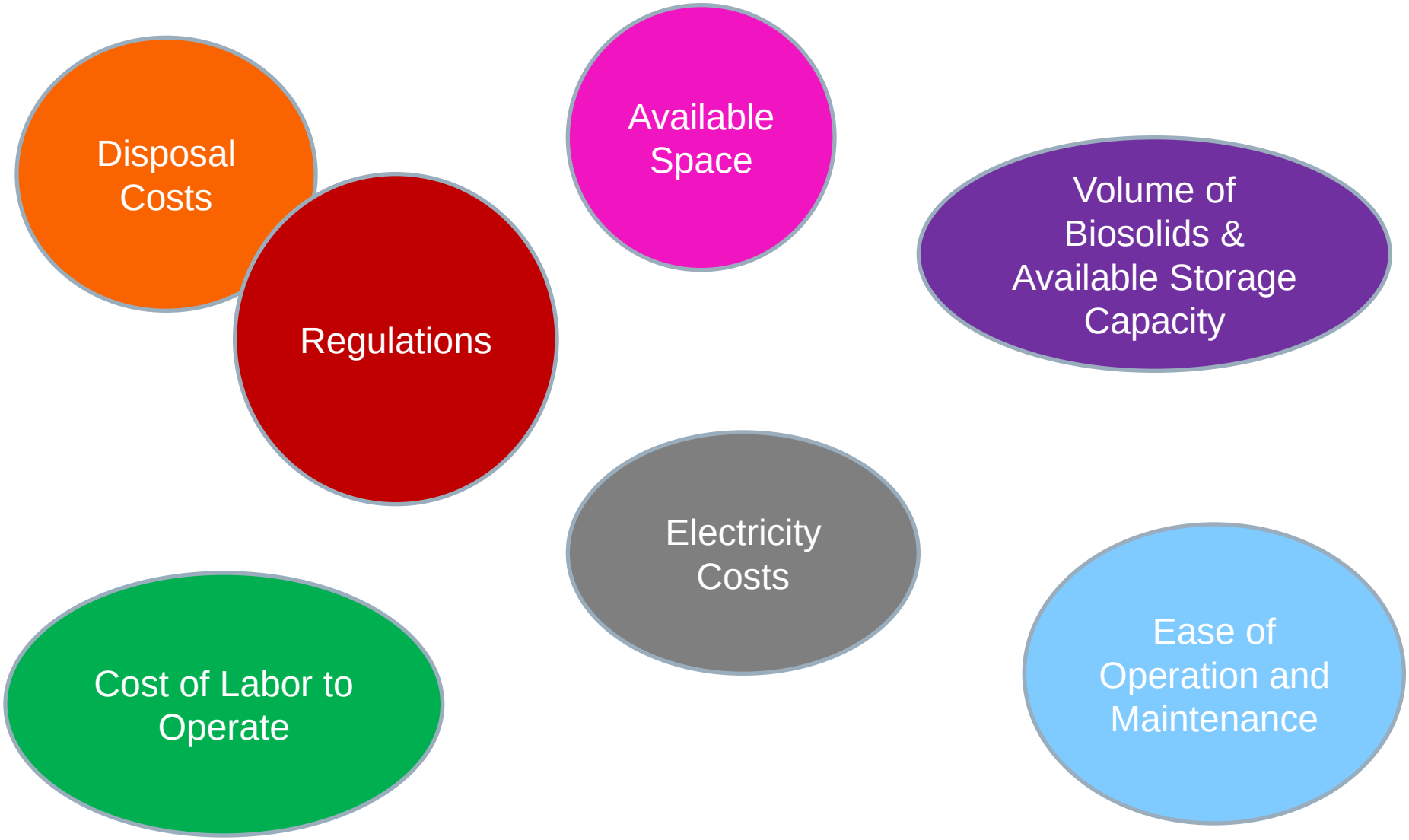
Dewatering Selection

Why dewater anyway?

Solids have to go somewhere,
And this costs $!

Drivers for Dewatering Equipment Selection



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Title of presentation

Contents

- **Chapter 1: Overview of Some Dewatering Equipment Options**
  - **–Belt Filter Press**
  - **–Centrifuge**
  - **–Screw Press**
  - **–Filter Press**
- **Chapter 2: Performance of Various Equipment Options**
- **Chapter 3: Sludge Characteristics**
- **Chapter 4: Process Defines Dewaterability**

Dewatering Equipment Selection

Belt Filter Press

- Operates on the theory of incrementally increasing the stability of the sludge by increasing applied pressure
- Flocculation → Gravity drain → Wedge pressure → High pressure rollers

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Dewatering Equipment Selection

Belt Filter Press

Belt Filter Press Operation

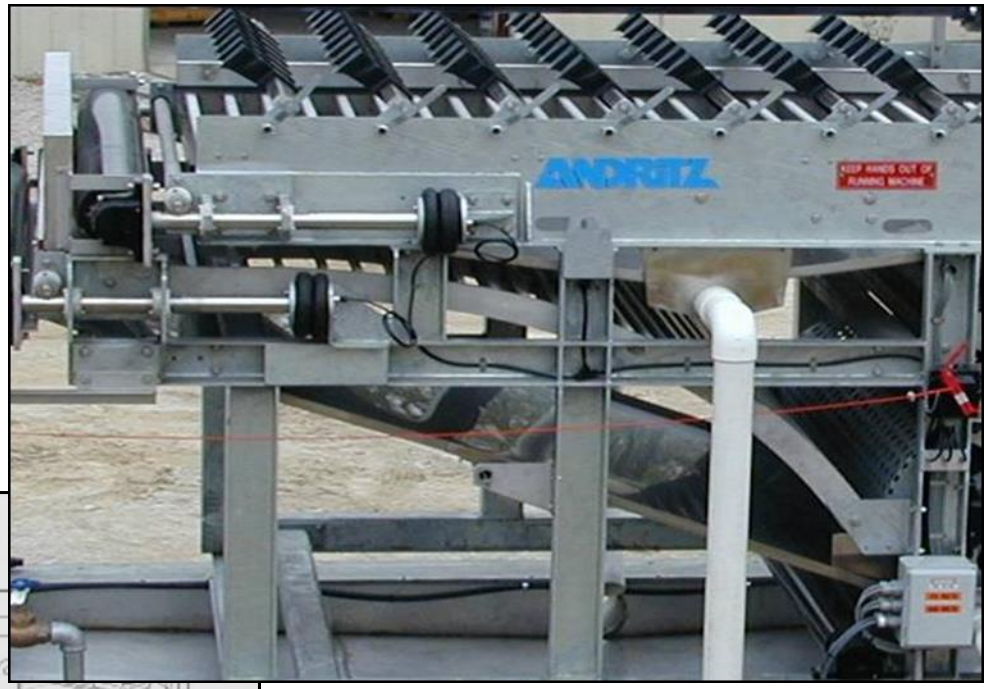
Gravity Zone

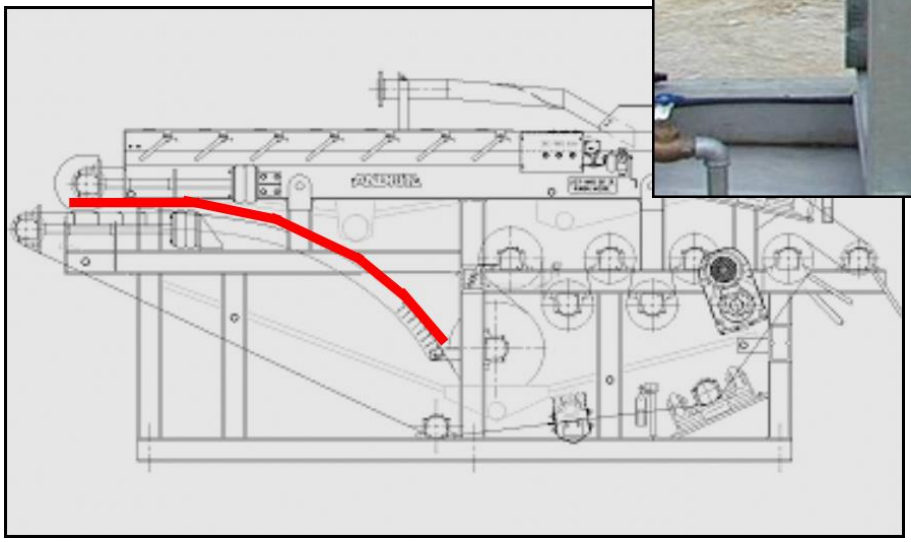
Dewatering Equipment Selection

Belt Filter Press

Belt Filter Press Operation

Wedge Zone





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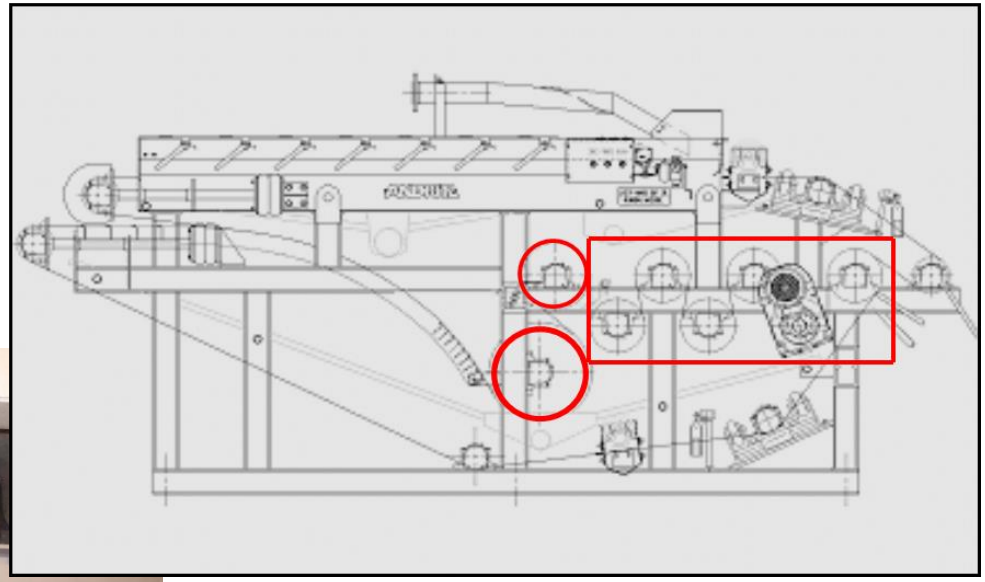
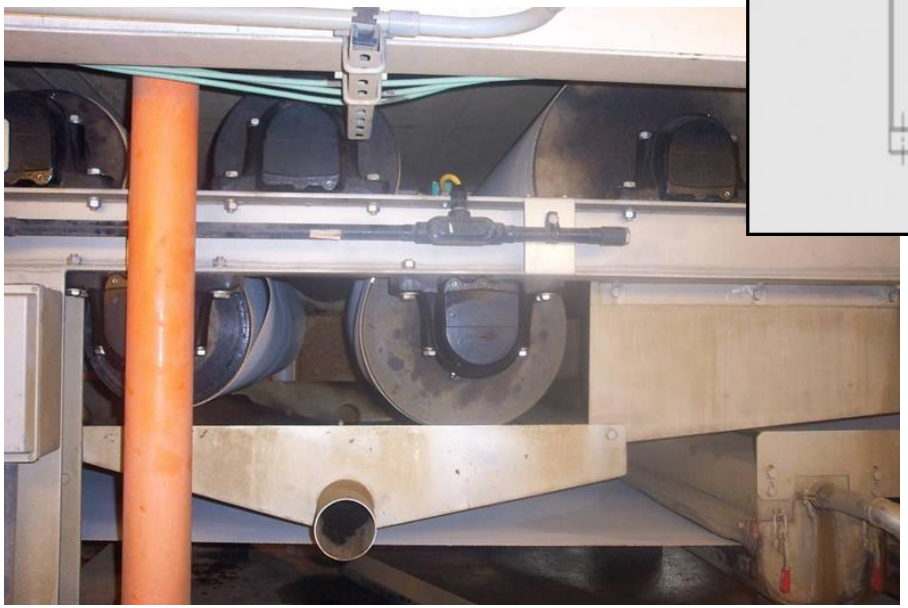
Dewatering Equipment Selection

Belt Filter Press

Belt Filter Press Operation

S-Roll Zone





Dewatering Equipment Selection

Belt Filter Press

Belt Filter Press Operation

Cake Discharge

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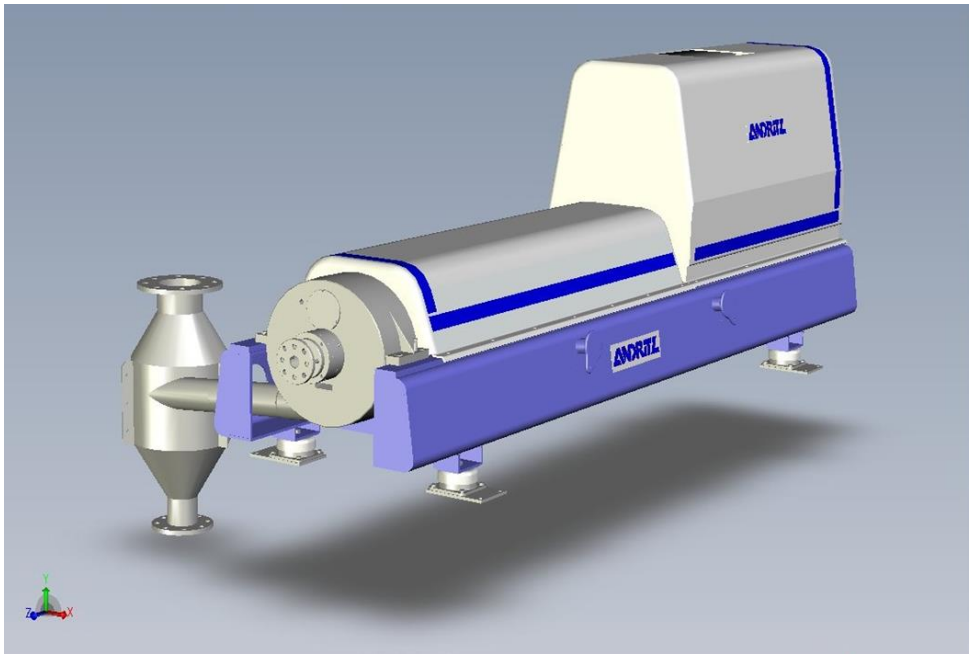
Dewatering Equipment Selection

Centrifuge

- Operates on the theory of applying centrifugal force to flocculated solids in a bowl, conveyed out by a scroll- operating at slightly different speeds
- Polymer injection → Solids plug formation → 3000 X G + bowl/scroll differential



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Centrifuge Operation

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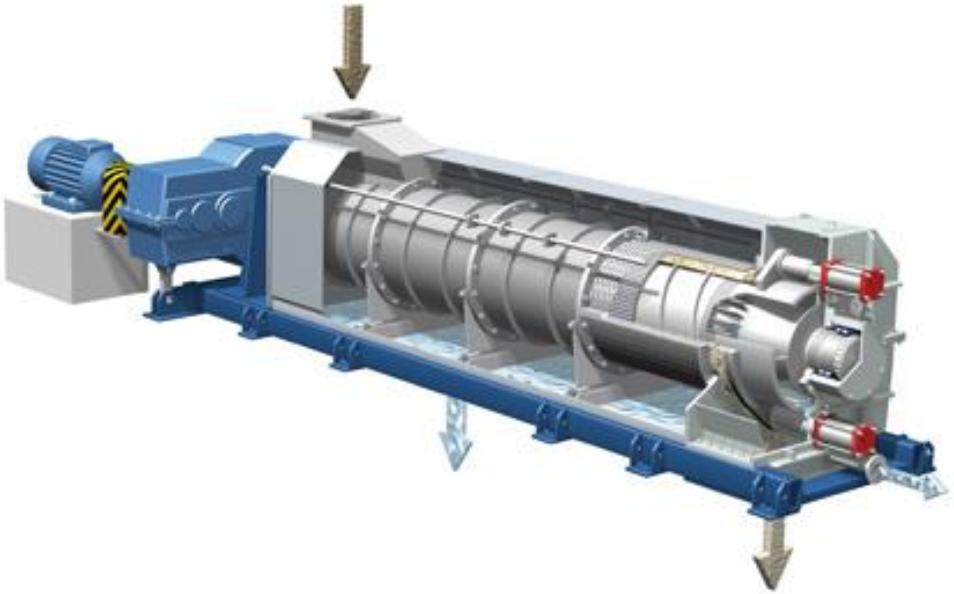
Dewatering Equipment Selection

Screw Press

- Operates on the theory of solids conveyance through a cylindrical screen which offers decreasing volume through the use of an increased shaft diameter
- Flocculated sludge → Feed hopper → Cylindrical screen → Compression and back pressure



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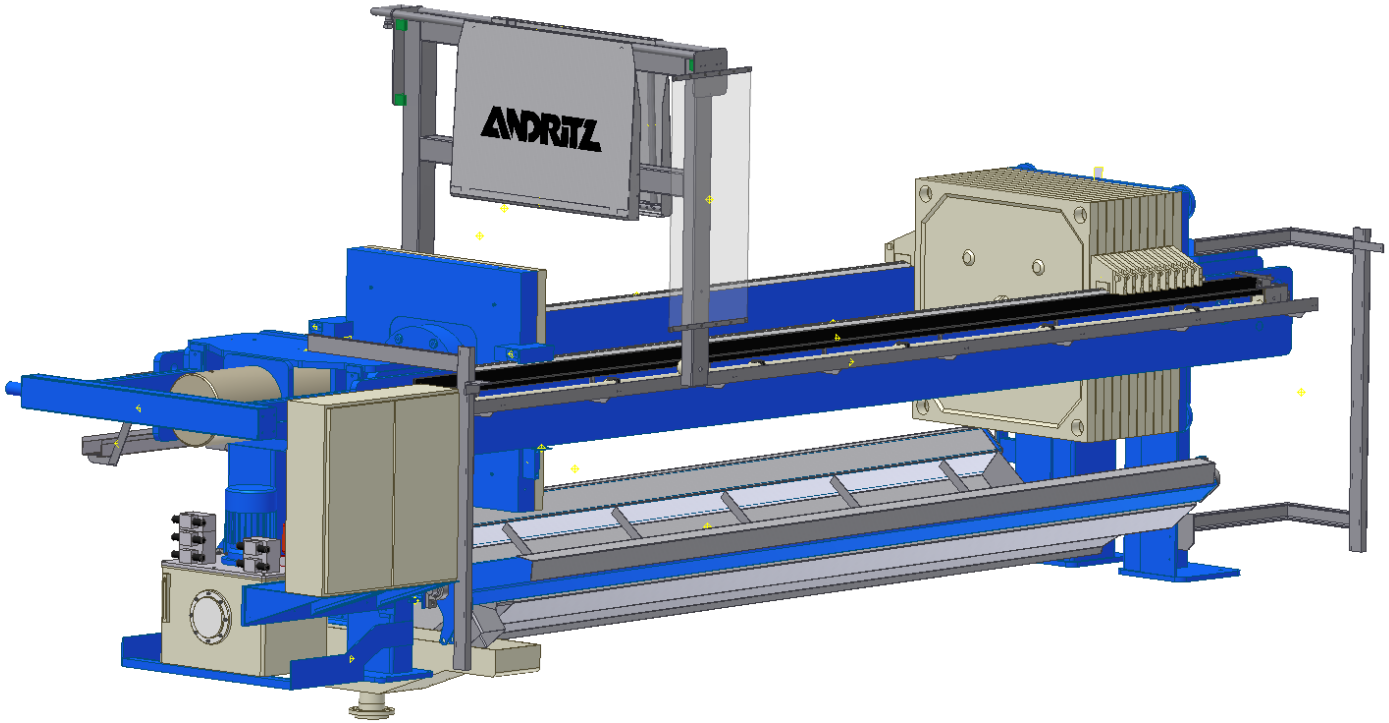
Dewatering Equipment Selection

Filter Press

- Operates on the theory of a pump feeding solids into a fixed volume press, which causes an increase in pressure within the press.
- Conditioned feed → Pumped in at 100 to 225 psi → Increase in pressure due to fixed volume → Solids captured on filter cloths



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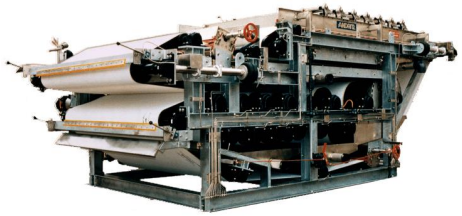
Dewatering Equipment Selection

Belt Filter Press vs. Centrifuge



	Belt Filter Press	Centrifuge
Footprint	Large space plus clearance	Small space and clearance
Odor Containment	Open design	Fully enclosed
Labor Requirement	Requires operator attention	Fully automated, low attention
Chemical Conditioning	Typically 10 - 30% less polymer	Typically 10 - 30% more polymer
Cake Dryness	Typically 4 - 8% less on same sludge	Typically 4 - 8% higher on same sludge
Capture Efficiency	Typically >95% except on dilute sludge	Typically >96%
Wash Water Requirement	Continuous 40 gpm/meter @ 120 psi	Only at alarm or shut-down
Power Consumption	Typically lower	Typically higher
Automation	Partial automation	Fully automated
Maintenance	See recommended maintenance	See recommended maintenance
Operator Friendly	Less	More

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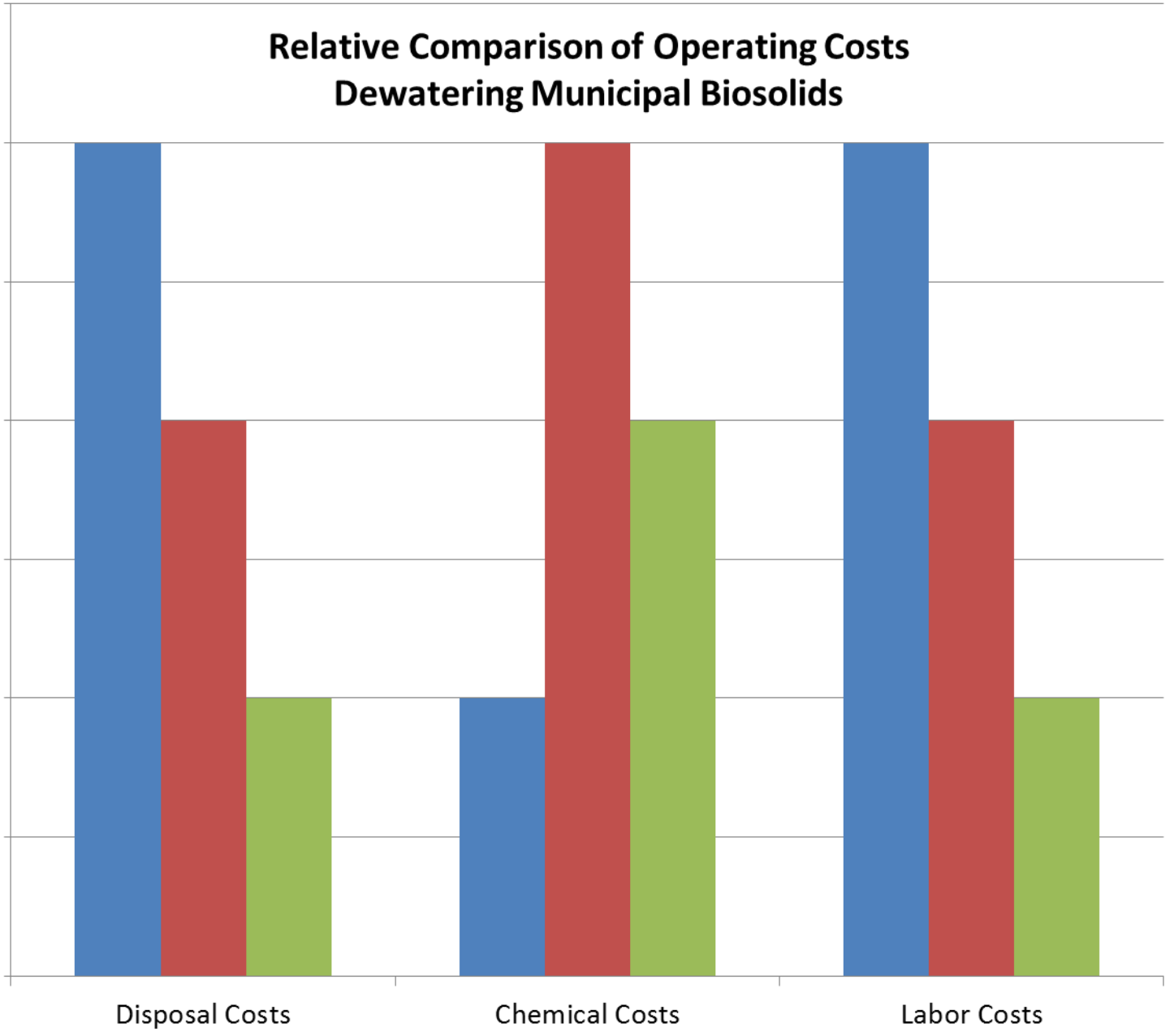

Relative Comparison of Operating Costs
Dewatering Municipal Biosolids
Belt Filter Press
Screw Press
Centrifuge
Disposal Costs
Chemical Costs
Labor Costs

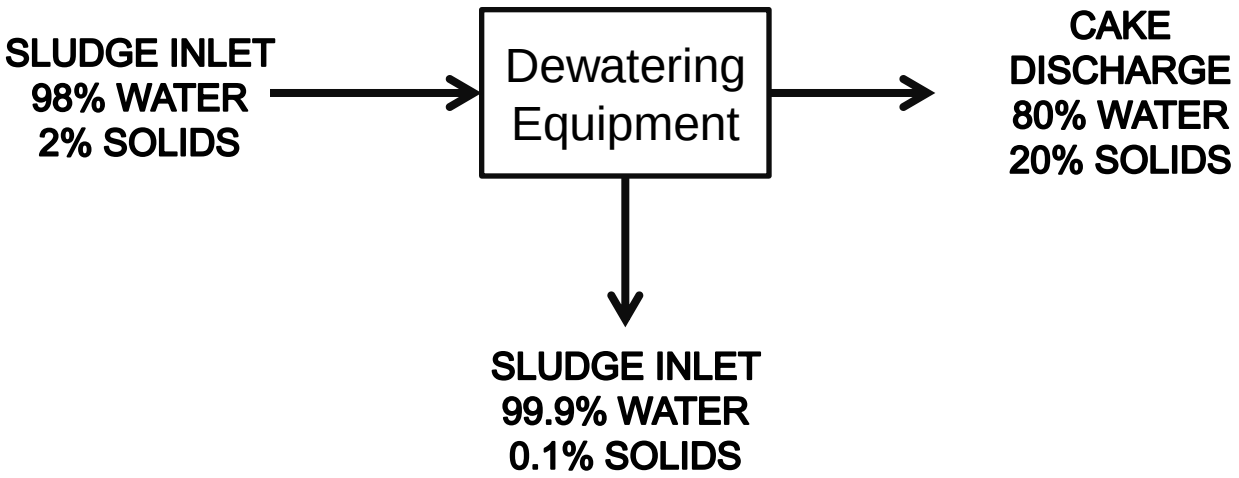
Dewatering Equipment Selection

Sludge Characteristics

Type of sludge and charateristics of each will have impact on decision of type of equipment.

Key Characteristics of Sludge for Dewatering Equipment Suppliers

1) Suspended Solids Content – Key for throughput calculations and mass balance



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Dewatering Equipment Selection

Sludge Characteristics

Key Characteristics of Sludge for Dewatering Equipment Suppliers

2) Ash / Volatile Solids Content – More importantly the amount of biological solids.

   Volatile Solids relates with the amount of biomass solids which are 99+% water and can be hydrophillic.

   Ash Content relates with the amount of non organic material which is typically easier to dewater. Sand, Silt, etc.

Dewatering Equipment Selection

Sludge Characteristics

Key Characteristics of Sludge for Dewatering Equipment Suppliers

3) Screen Analysis – Used for determination of size and type of solids.

Larger particles including fiber are easier to dewater. They can help form a matrix to apply pressure and even aid in capturing finer solids.

Fiber usually retained on the 30, 50, 100 mesh sieves (600, 300, 150 microns) Also can help determine the amount of sand / grit which can cause abrasion.

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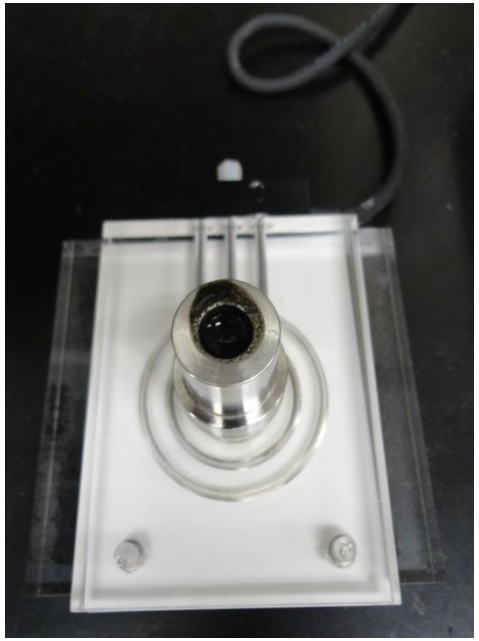
Dewatering Equipment Selection

Sludge Characteristics

Key Characteristics of Sludge for Dewatering Equipment Suppliers

4) Capillary Suction Time – An older test Standard Methods 2710 G

   A good indicator of how sludge releases water, how much coagulant or flocculant will be required.



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Dewatering Equipment Selection

Process Defines Dewaterability

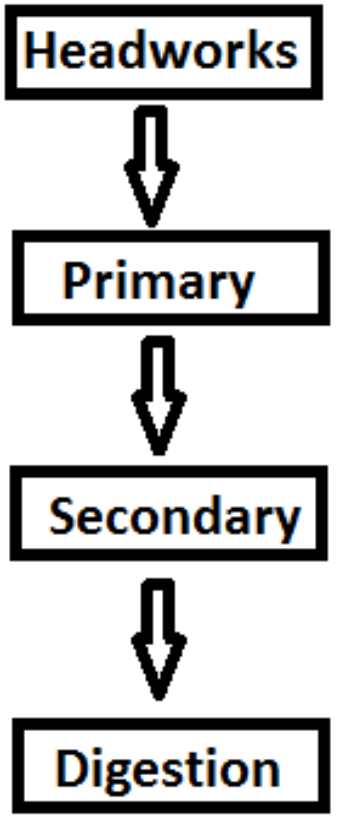
Sources of Solids / Biosolids

Headworks – Screened Solids / Grit Removal

Primary Clarifiers

Secondary Clarifiers

Digestion – Anaerobic, Aerobic, ATAD, etc



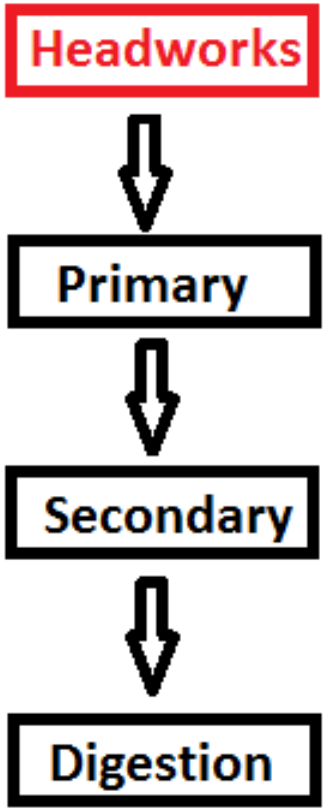
Dewatering Equipment Selection

Process Defines Dewaterability

Headworks

Screens – Perforated, Wedgewire, Bar, etc
Solids are typically disposed in landfill. Compaction sometimes used to dewater / remove organics prior to landfill

Grit Removal – Grit, Sand, Silt, Gravel, etc
Solids are typically disposed in landfill



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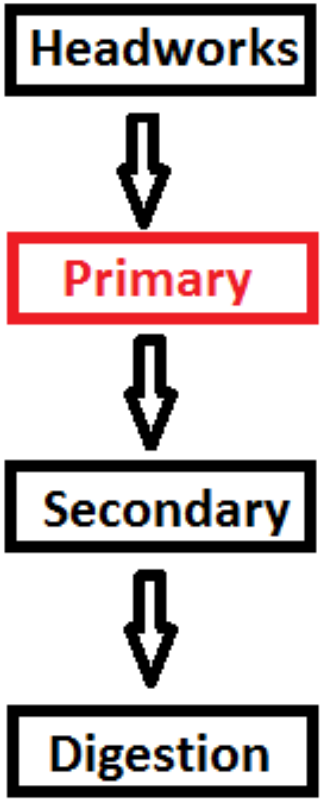
Dewatering Equipment Selection

Process Defines Dewaterability

Primary Sludge - Settleable solids and scum

Solids Concentration – 2 to 4%TS
Volatile Solids Content - 70 to 85%
pH – 5-7
Odor – Fecal, Septic
Color – Black to Dark Green or Dark Brown
Solids Description -
Larger suspended solids that settle out. Typically fibrous (tissue paper), large organic debris not capture in screens. 25-40% of suspended solids larger than 45 microns.



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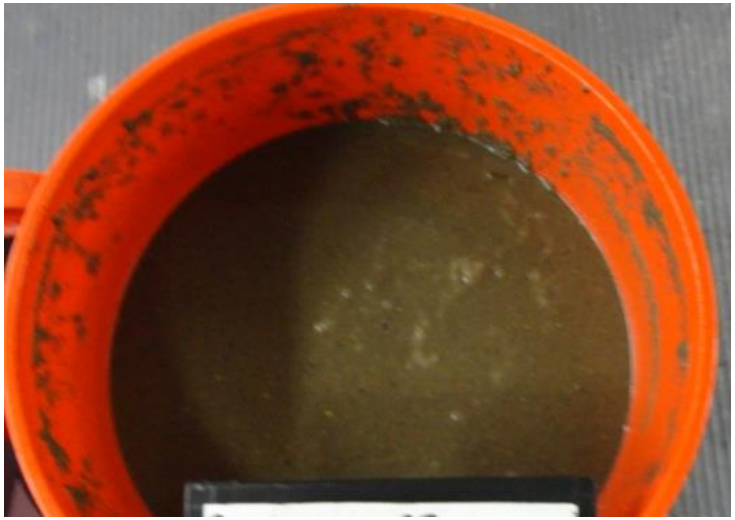
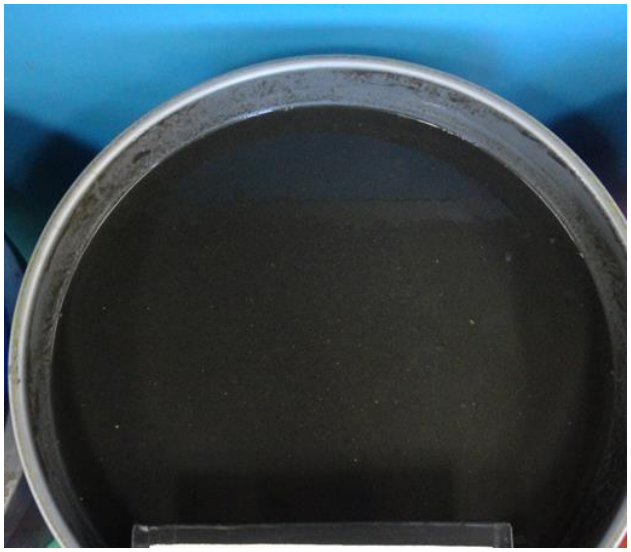
Dewatering Equipment Selection

Process Defines Dewaterability

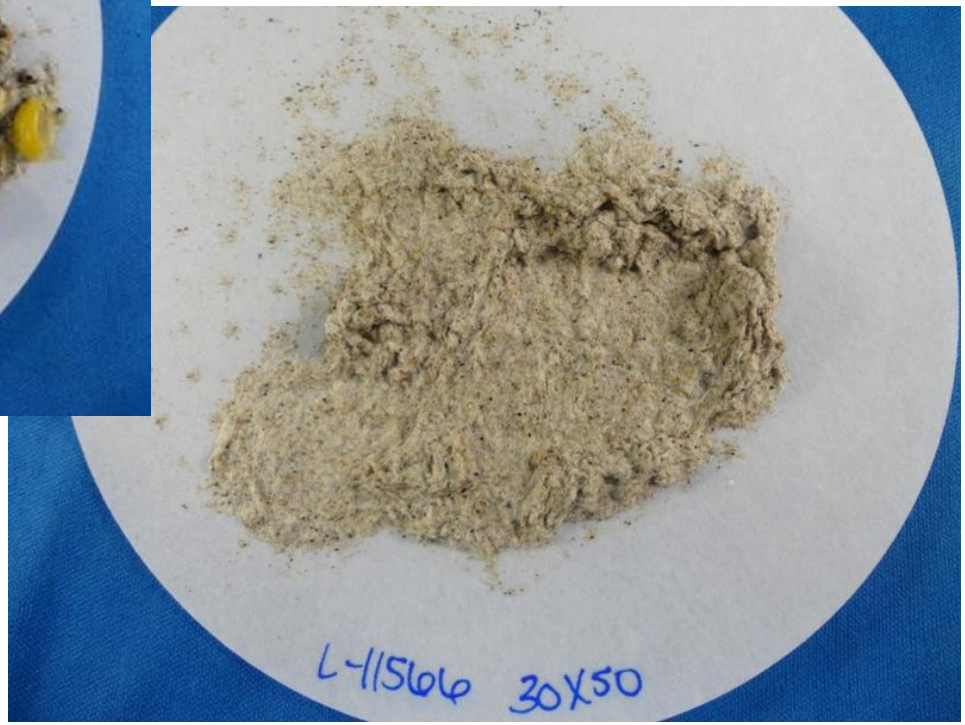
Primary Sludge





Dewatering Equipment Selection

Process Defines Dewaterability

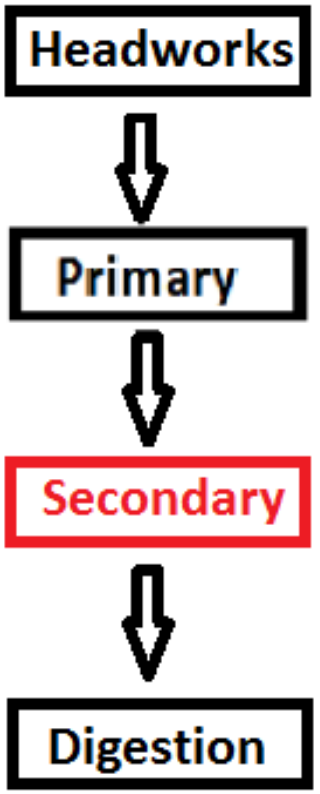


Dewatering Equipment Selection

Process Defines Dewaterability

Secondary Sludge – Biological Treatment Sludge
Waste Activated Sludge, Sequence Batch Reactor, Oxidation Ditch

Solids Concentration – 0.3 – 2.0%TS
Volatile Solids Content – 65 – 85%
pH – 6 – 8
Odor – Faint humic
Color – Light Brown to Tan
Solids Description –
Biological, Smaller Particle size only 10-20% larger than 45 microns



MBR Sludge typically has lower solids and even smaller particle size with 5-10% larger than 45 microns

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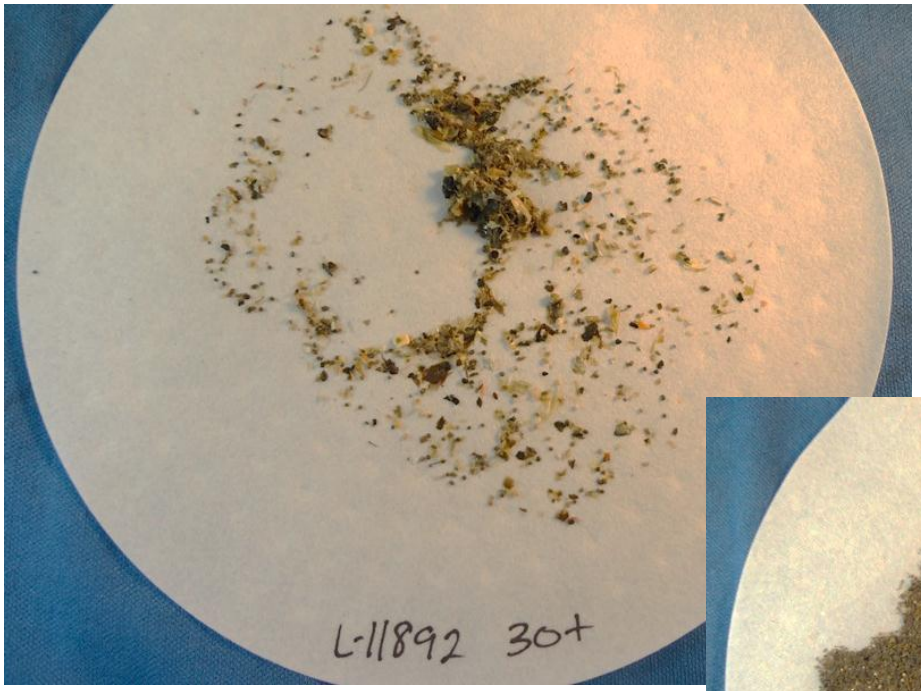
Dewatering Equipment Selection

Sludge Characteristics

Secondary Sludge

Dewatering Equipment Selection

Process Defines Dewaterability

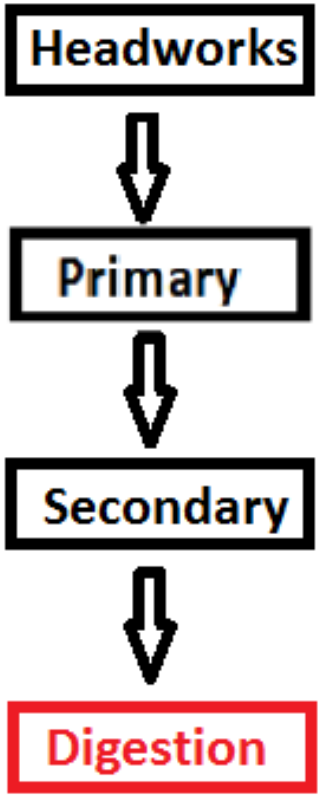


Dewatering Equipment Selection

Process Defines Dewaterability

Digestion
Anaerobically Digested

Solids Concentration – 2 to 4%TS
Volatile Solids Content – 55-65%
pH – 6 – 8
Odor – Humic
Color – Black / Dark Brown
Solids Description –
Biological, Little to No Debris or Fiber, Only solids too large to break down and were not removed during screening



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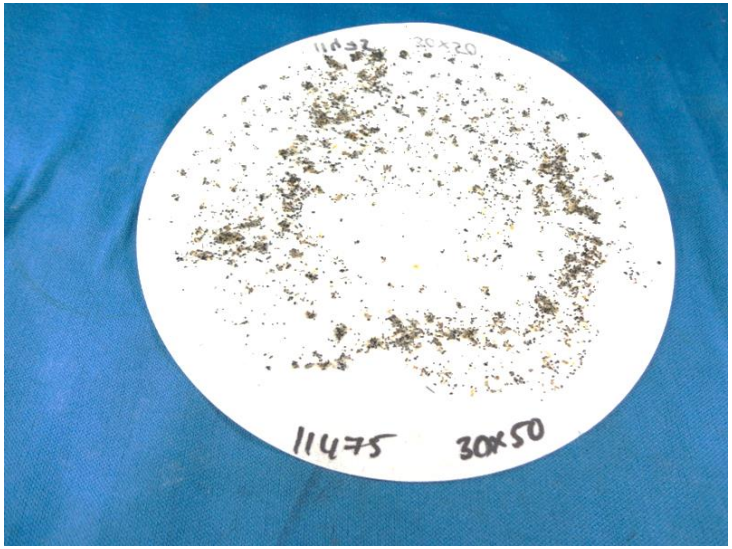
Dewatering Equipment Selection

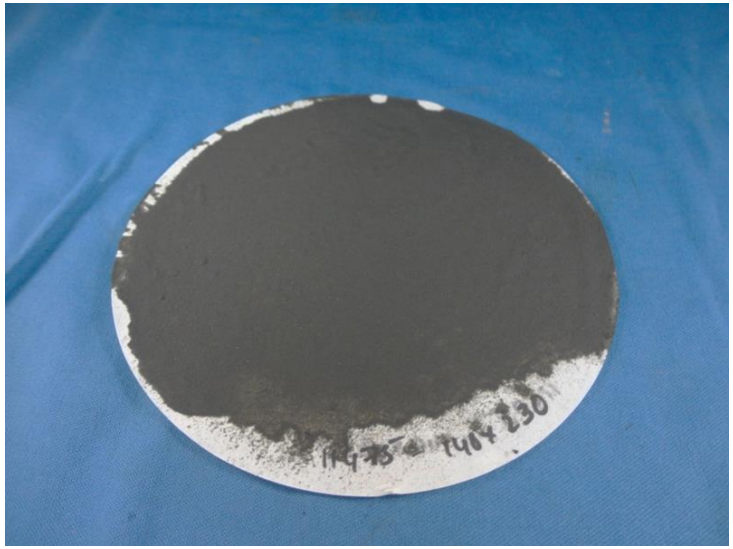
What are you dewatering?

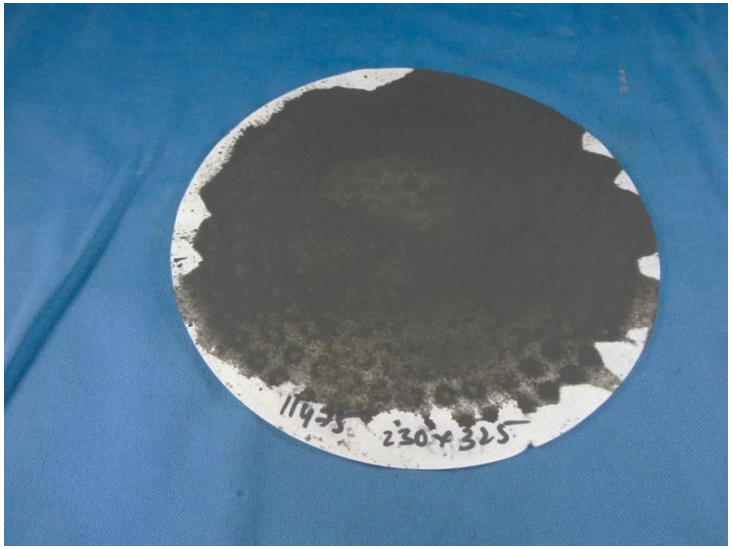
Anaerobically Digested

Dewatering Equipment Selection

Process Defines Dewaterability





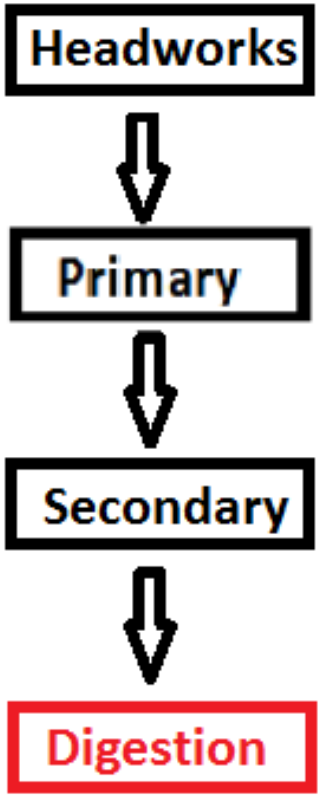


Dewatering Equipment Selection

Process Defines Dewaterability

Aerobically Digested

Solids Concentration – 1 to 2%TS
Volatile Solids Content – 60-75%
pH – 6 – 8
Odor – Humic
Color – Brown, Tan
Solids Description –
Biological, Little to No Debris or Fiber, Only solids too large to break down and were not removed during screening



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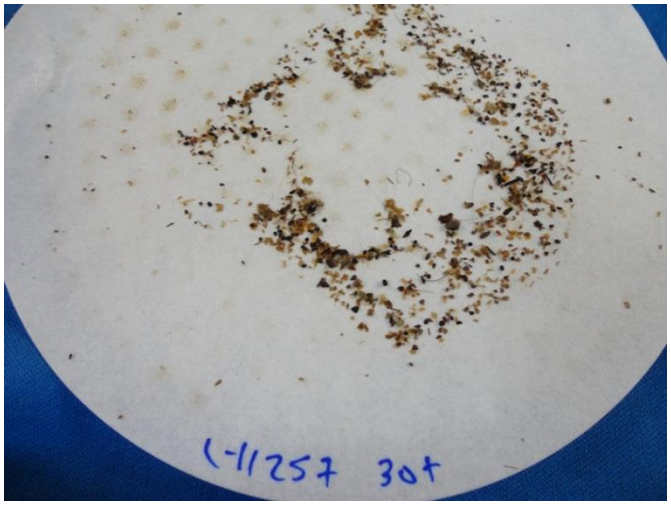
Dewatering Equipment Selection

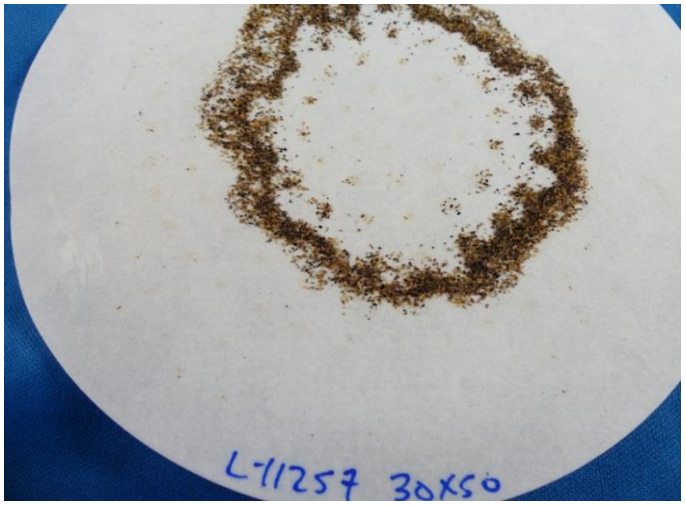
Process Defines Dewaterability

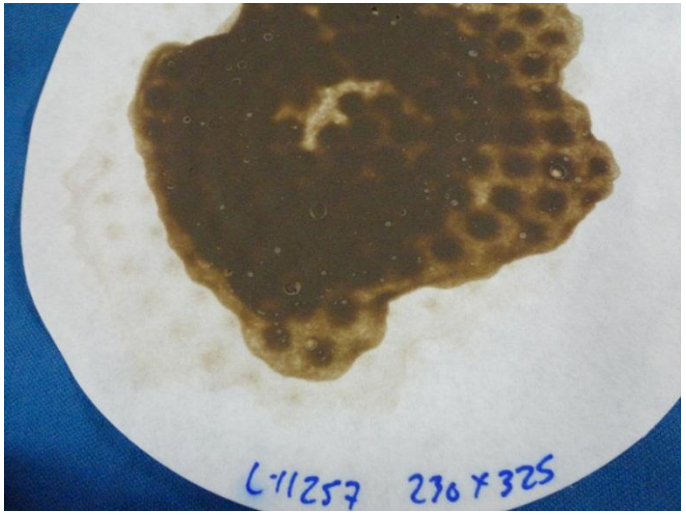
Aerobically Digestion

Dewatering Equipment Selection

Process Defines Dewaterability







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Dewatering Equipment Selection

Performance

	Belt Press		Screw Press		Centrifuge		Filter Press	
	Cake Solids	Poly	Cake Solids	Poly	Cake Solids	Poly	Cake Solids	Poly
Anaerobic	15-17	21-23	21	32	23-26	20-22	-------	-------
Aerobic	15-16	14-16	20	25	19-22	20-22	-------	-------
WAS	15-16	14-16	*	*	17-20	18-20	-------	-------
Primary	25-29	9-11	-------	-------	20-35	11-12	-------	-------
Lime (WTP)	30-50	2-5	-------	-------	55-65	0	60-65	0
Alum (WTP)	15-20	5-10	-------	-------	22-26	8-12	20-30	0-5

BFP data from lab simulations (± 0.5%)/ Centrifuge data from full-scale pilot tests
Screw press data from Huber's "Predicting Screw Press Performance" presented at 2011 WEFTEC

Units: Cake Solids (%TS), Polymer Dosage (active lbs/ton)

*Similar to Aerobic results, as stated by Huber

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Dewatering Equipment Selection

Summary

- The needs and priorities of each plant will vary
- Every sludge is different
- A holistic approach yields the best dewatering selection
  - Disposal options and limitations
  - Space availabilty
  - Regulations
  - Electricity costs
  - Labor costs
  - Storage capacity
- Sludge characteristics influence the dewaterability of sludge, so

Bench Testing and/or Pilot Testing are always recommended!

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