Wastewater Screening Workshop Options

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WASTEWATER SCREENING OPTIONS

PROTECTING YOUR INVESTMENT WILL PROVIDE QUICK PAYBACK

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PURPOSE: WHY SHOULD WE SCREEN?
SHORT ANSWER: PROTECT DOWNSTREAM PROCESSES

• REDUCE DOWNSTREAM MAINTENANCE LABOR
  • CAN DIRECT LABOR TO OTHER AREAS IN THE PLANT
• INCREASE DOWNSTREAM PROCESS SYSTEM LIFE SPANS
• MAINTAIN DESIGN EFFICIENCIES
• REDUCE SPARE PARTS ON DOWNSTREAM PROCESSES
DISCUSSION TOPICS

• General screen product characteristics
• Headworks Screens
• Solids Handling
Wastewater Screens
Purpose: Why should we screen?  
Short Answer: protect downstream Processes

- Removal of untreatable solid materials (inert material), thereby:
  - Reduce maintenance labor
  - Can direct labor to other areas in the plant
  - Increase downstream process system life spans
  - Maintain design efficiencies
  - Reduce spare parts on downstream processes
What happens when inert solids are not screened – Eastern US municipality
Importance of screening design and function

- In general, seen as less longevity than surface water screens
  - Harsher environment – materials of construction
  - H\textsubscript{2}S has increased as a concern as odor control becomes more prevalent.
  - Corrosion increases at southerly installations and near ocean installations
- Design for peak flow
- Consideration at low flows and average daily flows
- Maintenance vs capture rate
Types of Screens surfaces

Bars / slots

Filter Element

Perforated

Mesh
Types of Screens surfaces

- Bars (Rake Screen)
  - Capture Rates – 20% to 30% at ¼ inch
  - Lower Capture Rates
  - Lower Maintenance

- Filter Element Belt
  - Capture Rates – 60% to 70%

- Aqua Guard Perforated Belt
  - Capture Rates – 80%+
  - Higher Capture Rates
  - Higher Maintenance

Higher Maintenance
Higher Capture Rates
Screen Categories

- Coarse vs. Fine
- 3/8” to 3” vs. 1/4” and less
- Manual vs. Self Cleaning

TREND

As regulations tighten, downstream process become more sensitive, screening requirements become finer
Types of headworks screens

- Bar screens
  - Multirake screens
  - Catenary screens
  - Modified catenary screens
  - Reciprocating screens (grabbers, climbers)
- Element belt screens
- Perforated screens
- Step screens
- All in one
- Internally fed drum screens
- Externally fed drum screens
Bar screens – multirakes

- Stainless steel materials
- Multiple rakes on the rack at all times
- No carryover of solids
- Designs incorporated lower sprocket
- Low capture rates
Bar screens – catenary screens

- Stainless steel materials
- No sprockets in the water
- Rake can move away from screen surface for large objects
- Requires large footprint
- Low capture rates
Bar screens – modified catenary screens

- Stainless steel materials
- No sprocket in the water
- Very low maintenance
- Can carry large objects
- Same footprint as other bar screens
- Low capture rates
- Higher cost than other bar screens
Bar screens – modified catenary screens
Reciprocating screen

- Typically used as trash racks
- Single rake on each mechanism
- Capable of removing large debris
- No carry over
- Requires sufficient headroom for rake operation
Filter Element belt screens

- Stainless steel materials
- Elements available in ss and polymeric
- High capture rates
- Recently modified designs reduce maintenance and reduce carryover
- Carryover potential
Filter element belt chain Construction
Aqua Guard Element Movement

FILTER ELEMENT BELT CHAIN MOVEMENT
Filter element belt screens - innovations

Advances:
1. Extended belt path improves solids release.
2. Brush location moved closer to center of hopper.
3. Dual sprays for solids removal.
4. UltraClean brush w/ rubber wipers
5. Side removal of brush.
6. Cover design gives operators easier access
Filter element belt installations

Granite Falls, MN pump station

Akron, OH CSO application
Perforated belt screens

- Stainless steel materials
- High capture rates
- Stainless steel and polymeric perf panels
- Increased maintenance
- Susceptible to plugging
Perforated belt screens

- Improved capture rates, when maintained properly
- Typically 2 mm, 3 mm, and 6 mm perforations
- Solids carried out of channel
  - Rakes
  - Perforated shelf
Perforated belt screens

- Panels with shelves
- Curved panels
Step screens

- Stainless steel materials
- Mat formation increases capture rate
- Simple motion
- Low discharge height
- Greater footprint
- Blade damage can shut down machine
Step screens

- extremely low headloss
- handling of heavy solids loading
- Single pass design - no brushes for removing solids from the screening surface
- very economical
- especially good at handling flows containing high fibrous-like content
Step screens
All in one

- Stainless steel materials
- Screening, conveying, compaction in single unit
- Perforated or vee wire screening
- High capture rates
- Flow limited
All in one Applications

- Peak Flow 6.5 MGD
- Optional Spray Bar for industrial applications
- Angle of inclination 35° and 45°
- Self contained compact zone
- Available bagger
- Frost protection for some applications
All in one Applications

- To finer screens 1/8 & 1/4 inches
- Elimination of grinders – ground solids are not trouble free inside the treatment plant
- Retrofit – upgrade of existing WWTP’s
Septage Screening Units
Internally fed drum screens

- Stainless steel materials
- All parts are at operating deck
- Best capture rates
- Screen sits above channel
- Required for membrane plants
- Pumping required
- Flow limited
- Screen surface:
  - Perforations
  - Vee wire
Internally fed drum screens
INTERNALLY FED DRUM SCREENS
- Externally fed drum screens
  - Stainless steel materials
  - All parts are above the operation deck
  - Best capture rates
  - Smaller flows
  - Vee wire screening
Comparison testing
Testing site

- Headworks screens
- Grit removal
- Primary clarifiers
- IFAS Train
  - integrate fixed-film activated sludge
- Secondary clarifiers
- UV disinfection
Test site conditions

- Redundancy in design
- Parallel influent channels
  - Designed to allow peak flow thru a single channel
- Single washer compactor
- Plant process flow
  - Peak design of 12.0 MGD
  - Max daily flow of 8.0 mgd
  - Daily flow averaging between 4.5 and 4.8 mgd
Test site equipment

- Bar screen – Aqua Caiman®
- Filter element screen – Aqua Guard®
Test site equipment

• Bar screen – Aqua Caiman®
  – Installed new 2017
  – Replaced manual screen in emergency by-pass channel
• Filter element screen – Aqua Guard®
  – Qty 1 installed in 1998, qty 1 installed in 2003
  – Screen surface and wear parts refurbished in 2012 and 2013
Testing site configuration
Testing site configuration
Testing objectives and methods

• Initial approach – dumpster weights
  – Same wash press for both types of screens
  – Forklift scale (used for pallet weighing)
  – Data collection was problematic
  – Gap still left for real world interpretation

• Maintenance labor
  – Improved efficiency for staff to collect data
  – Improved recording
  – Directly applicable to real world operations
Total AC and AG Screen Daily Maintenance hours

93% reduction in daily screen maintenance labor hours with the Articulating Rake Screen

- Bar Screen, Articulating Rake
- Filter Element Screen
AC and AG Downstream Maintenance Hours

- **Bar Screen, Articulating Rake**: 450 hours
- **Filter Element Screen**: 150 hours

70% reduction in downstream labor hours with the Filter Element Screen.
Total Screen Maintenance and Downstream Maintenance Labor Costs

- Each screen - 9 months of operation
- Yearly labor cost savings $15,900 with Filter Element
- Fully burdened labor rate

42% reduction in total labor cost with the Filter Element Screen

Bar Screen, Articulating Rake
Filter Element Screen
Case study: South Texas filter belt element screens Replaced Step Screens

- Qty 4 Step Screens installed in 2002
- Design Maximum Flow – 40 MGD 10 MGD per screen
- 4 ft wide x 10 ft discharge height 6 mm slots
- Screenings discharge to spiral conveyor and washer/compactor
- Issues:
  - No upstream protection of step screen
  - Low capture rates created operational inefficiencies

Headworks Facility
Case study: South Texas filter belt element screens Replaced Step Screens

- All 4 Step Screens removed 2013
- Qty 2 AG-MN-UC installed 2013, Qty 2 AG-MN-UC installed 2015

<table>
<thead>
<tr>
<th>Step Screen Performance</th>
<th>New Filter Element Screen Performance</th>
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<tbody>
<tr>
<td>8 hours labor per day to maintain pumps / sensitive equipment</td>
<td>8 hours labor in 2.5 years to clean pumps</td>
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<tr>
<td>4 hours labor per day to maintain screens</td>
<td>4 hours labor every 2 weeks to maintain screens</td>
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<tr>
<td>32 hours labor per quarter to drain and clean clarifier</td>
<td>NO hours labor for clarifier in 2.5 years</td>
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<td>Over 1,800 labor hours saved, so far.</td>
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<td>$75,000.00 saved, so far. (At $40/hour)</td>
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Washer compactors
Washer compactors
Washer compactors
Wash Press video
Thank you

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