



# *Screening Solutions*

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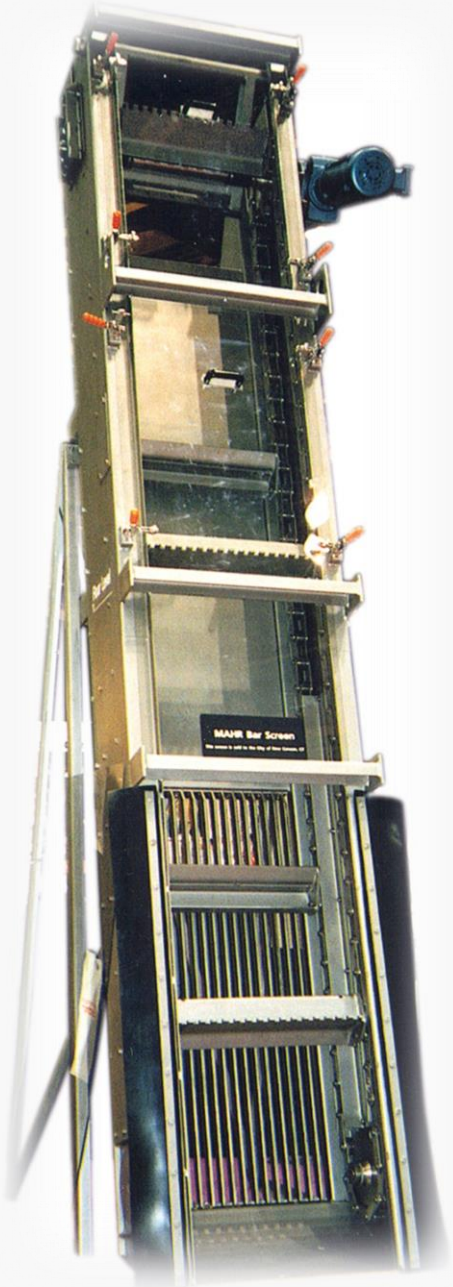
## *Agenda*

- *Primary Screening Overview*
- *Trend for finer screening*
- *Type of screening*
- *Selection*
- *Benefits of Fine Screening*
- *Consequences of Fine Screening*
- *Evaluation- plant needs, equipment, costs*

# Primary Treatment

**Removes:**

- Sand, grit, solids**
- 45-50% of Pollutants**



# Primary Treatment Processes



- Screening
- Grit Removal
- Septage Handling
- Odor Control
- Flow Equalization



# Screening



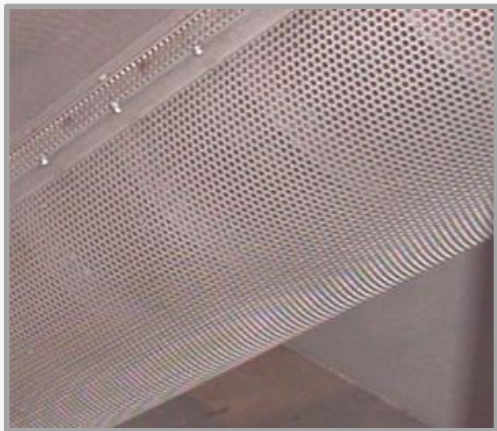
- **First unit of operation**
- **Removes floatables and solids**
- **Improves downstream processes**
- **Reduces maintenance**

# Trend Toward Finer Screening

- **Reduction of solids in downstream processes.**
- **Less damage, wear and plugging of pumps**
- **Protects downstream equipment**
- **Eliminates floating solids**
- **Cleaner final effluent/Higher quality reuse water**
- **Cleaner sludge**
- **Reduces maintenance**

# Trend Drivers

- Availability of more fine screen options
- Advanced biological processes
- Tightening regulations
- Availability of screening washing



# Types of screens based on openings and typical use

Screen Type	Typical Opening	Typical Use	
Trash racks	1.5" - 3.0"	Logs, timbers, stumps, large debris	Sees both dry and wet weather flows
Coarse bar screens	0.5" - 3.0"	Large solids, rags and debris	
Fine screens	0.06" (1.5 mm) - 0.5" (12 mm)	Fine solids removal	Typically follow coarse screens
Very Fine	0.01" (0.25 mm) - 0.06" (1.5 mm)	Can reach near primary treatment levels	Typically follow coarse &/or fine screens
Microscreens	1 micron-0.3mm (< 0.012")	Effluent polishing	

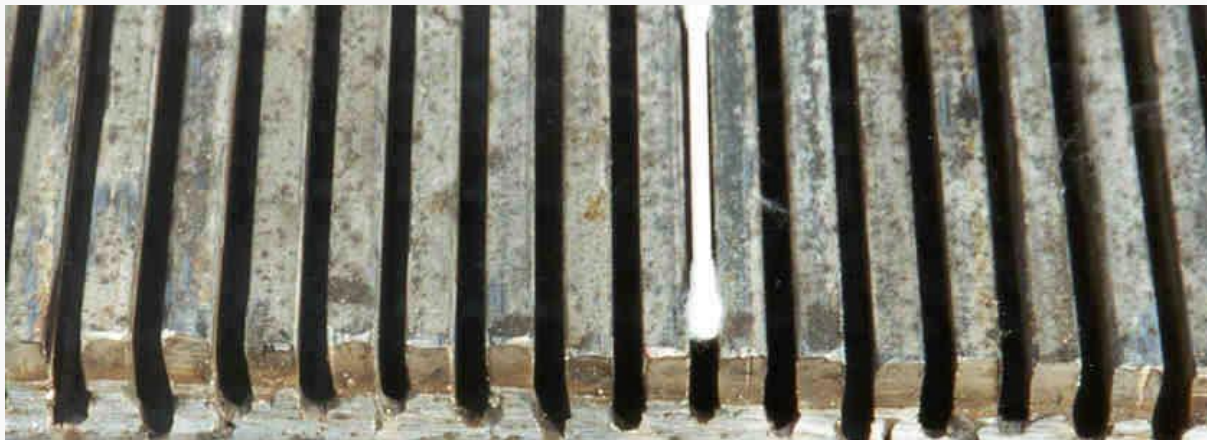
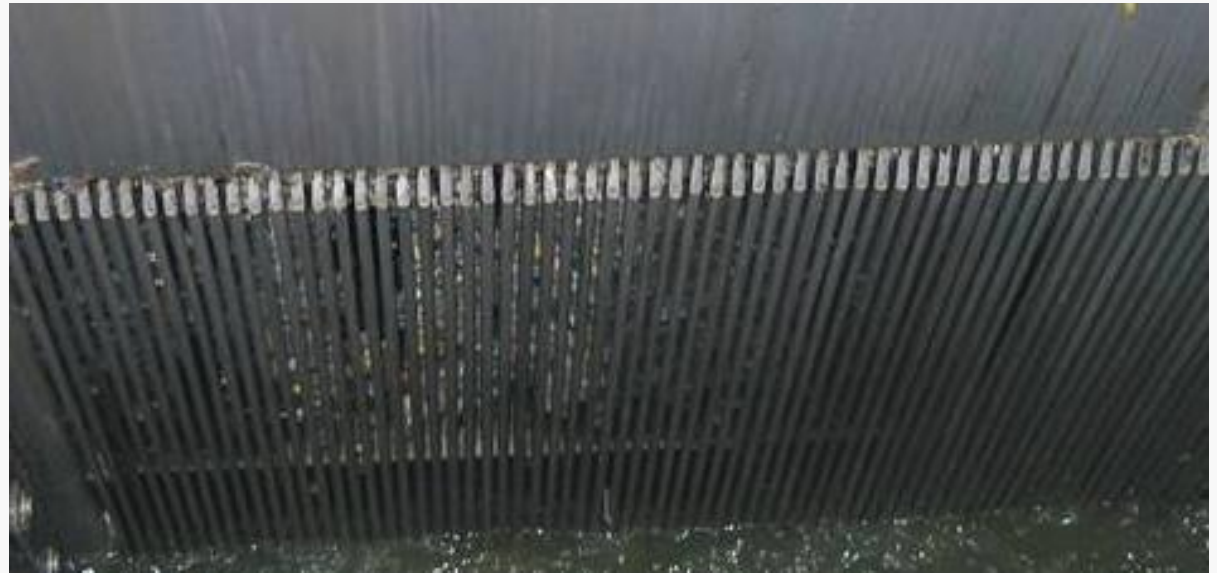


# Choosing a Screen

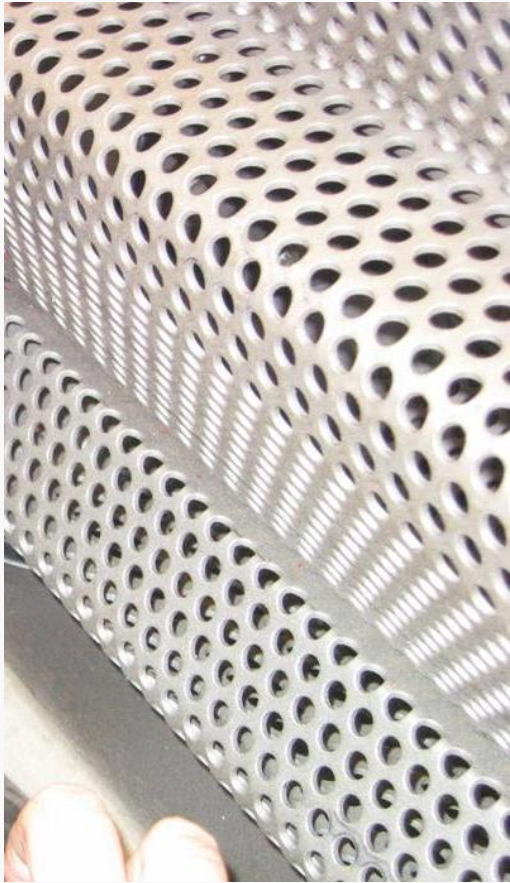
Efficiency	Effectiveness
Screen Media	Opening
Size	Cleaning
Materials	Flow
Headloss	New vs. retrofit
Solids Handling	Costs

# Types of Screen Media

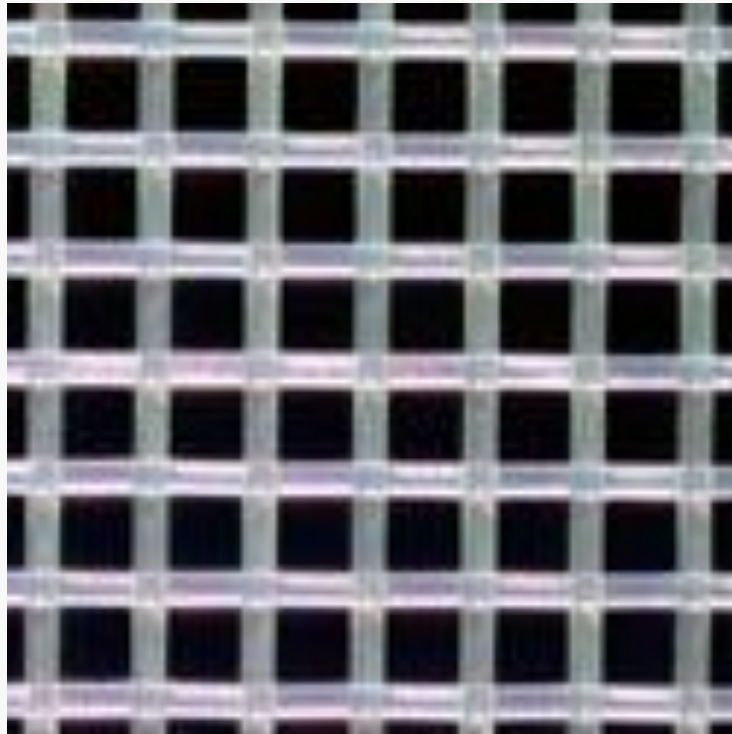
# Bars



# Perforated Plate



# Woven Wire





# Estimates of screening volumes per MG

Opening	Solids
1"	+/- 3 ft <sup>3</sup> /MG
3/4"	< 5 ft <sup>3</sup> /MG
1/2"	< 8 ft <sup>3</sup> /MG
1/4"	11 ft <sup>3</sup> /MG
1/8"	13-15 ft <sup>3</sup> /MG

# Methods of Cleaning

# Rake & Scraper



# Brush (& Wiper)



# Spray





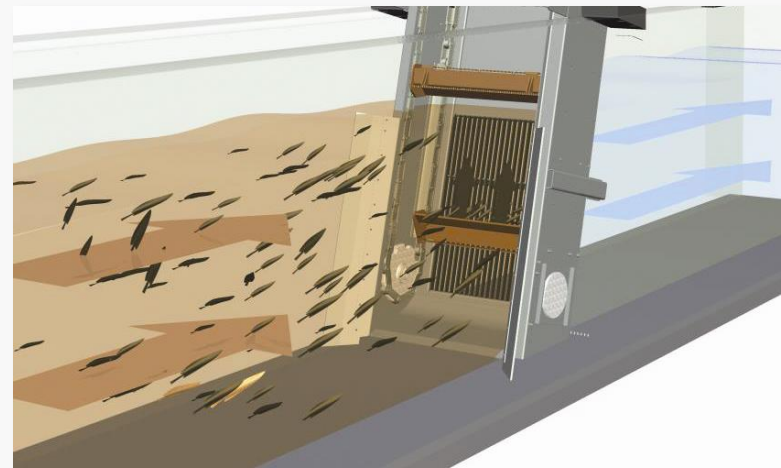
# Flow

## Screen first

- Size for instantaneous peak
- Consider operation at low flow

## Equalize first

- Solids may collect in basins or ponds



# Types of Screening Equipment

# Manual Screens

- **Coarse Screens**  
( $>1/2''$ )
- **Bar Screens**
- **Manually Cleaned**

<b>+ Strong</b>	<b>- Coarse</b>
<b>+ Inexpensive</b>	<b>- Manually cleaned</b>

# Mechanical Screens

<u>Screen Type</u>	<u>Screen Media</u>	<u>Typical opening</u>	<u>Category</u>
Multiple Rake Screen	Bar	4 mm + (3/16" +)	Fine-Coarse
Single Rake 'Climber' Type Screen	Bar	3/8" + (9 mm +)	Coarse
Continuous Belt	Bar, Perforated	3 mm (1/8") – 1/2" (12 mm)	Fine
Step Screen	Lamellas (plates)	2 mm (0.08") – 6 mm (1/4")	Fine
Spiral Screen	Perforated	1/8" (3 mm) – 1/4" (6 mm)	Fine
Band Screen	Perforated	2 mm (0.08") – 6 mm (1/4")	Fine
Drum Screen	Perforated, Woven Wire, Wedgewire	0.01" (0.25 mm) - 0.5" (12 mm)	Fine-Very Fine

# Multiple Rake Screens

<b>+</b> <b>Strong</b>	<b>- /+</b>
<b>Coarse or fine</b>	<b>Submerged Sprocket</b>
<b>Short cleaning interval</b>	
<b>Clears Obstructions</b>	
<b>Low headroom</b>	
<b>Easy to enclose</b>	
<b>No Carry Over</b>	







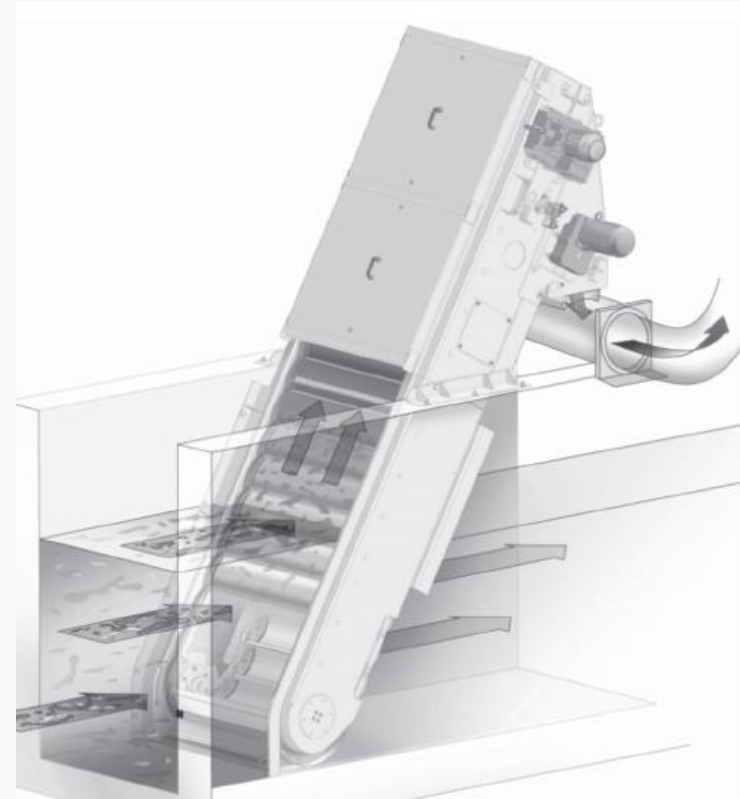
# Single Rake Screens

<b>+</b> <b>Strong</b>	<b>-</b> <b>Coarse</b> <b>(&gt;3/8")</b>
<b>No submerged parts</b>	<b>Long cleaning interval</b>
<b>No By-Pass</b>	<b>Skips over obstructions</b>
	<b>Room above top of channel</b>
	<b>Difficult to enclose</b>



# Continuous Belt Screens

<b>+</b> <b>Fine (3 mm)</b>	<b>-</b> <b>Carry-over</b>
<b>Low Headroom</b>	<b>Size of solids</b>
<b>Easy to enclose</b>	<b>Brush &amp;/or Spray</b>
	<b>Needs Protection</b>
	<b>Gaps in Frame</b>





# Side Seal System



# Step Screens

<b>+</b> <b>Fine (1–6 mm)</b>	<b>-</b> <b>Grit</b>
<b>Low Headroom</b>	<b>Size of solids</b>
<b>Enclosed above TOC</b>	<b>Maximum length &amp; width</b>
<b>No by-pass</b>	<b>Catastrophic Failures</b>
	<b>Needs Protection</b>





# Spiral Screens



# Spiral Screens

<b>+ Fine (3mm)</b>	<b>- Capacity</b>
<b>Combines Screening, Washing &amp; Dewatering</b>	<b>Needs Protection</b>
<b>No-By Pass</b>	<b>Maintenance</b>
	<b>Channel length</b>



# The Latest Technologies

- **Very Fine Screens**
- **Upstream Protection Required**
- **Water for Cleaning**
- **High Headloss**

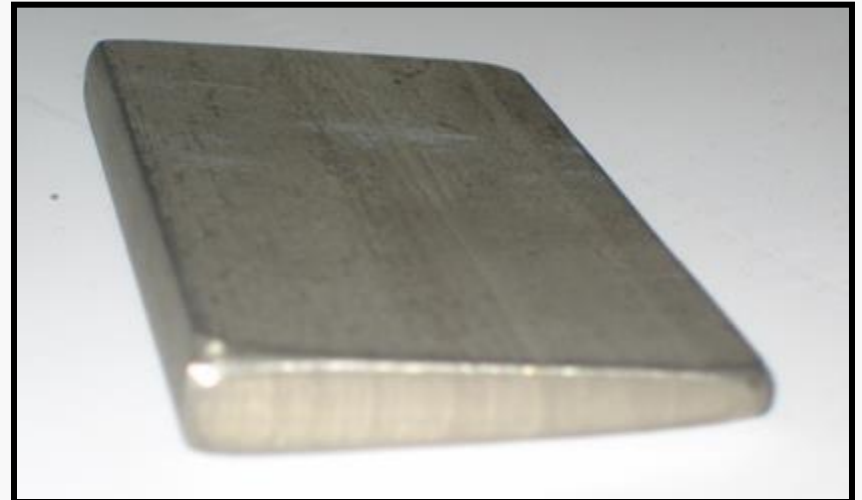
# Headloss Calculation

$$Headloss = \beta \times \left(\frac{w}{b}\right)^{\frac{4}{3}} \times \left(\frac{v^2}{2g}\right) \times \sin \phi$$

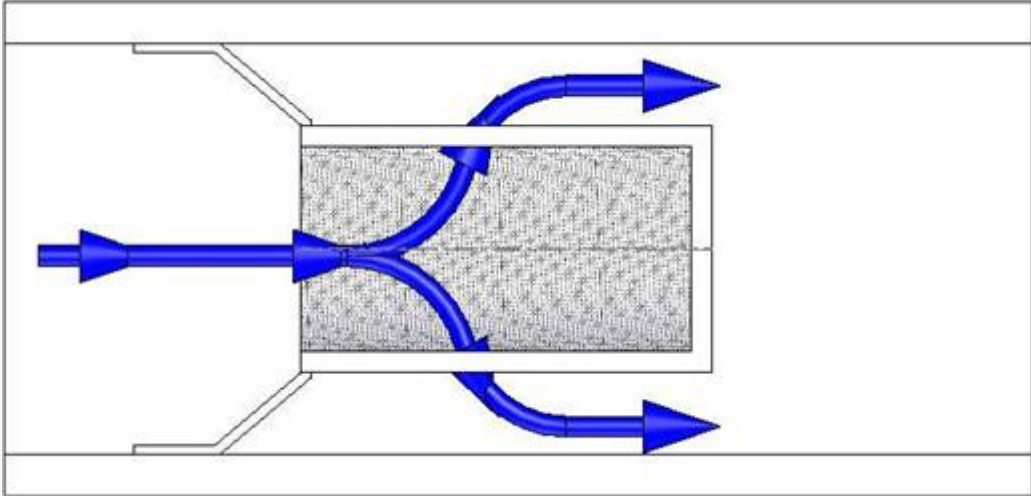
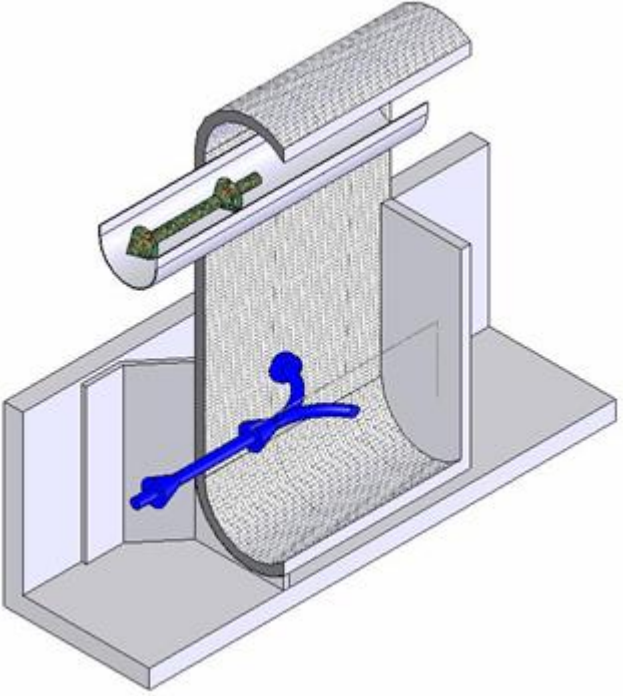
- $\beta$ : bar shape factor  
 $w$ : width of bar  
 $b$ : bar spacing  
 $v$ : approach velocity  
 $\phi$ : screen inclination angle

## Bar Shape Factor

<u>Bar Type</u>	<u><math>\beta</math></u>
Sharp-edged rectangular	2.42
Rectangular with semicircular upstream face	1.83
Circular	1.79
Rectangular with semicircular upstream and downstream faces	1.67
Tear shape	0.76



# Band Screens







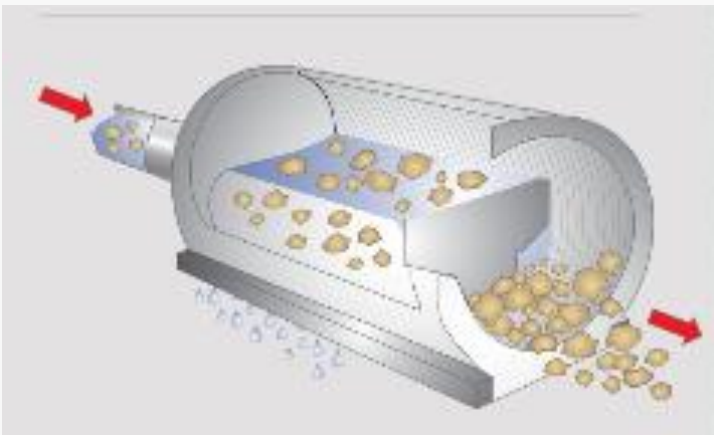
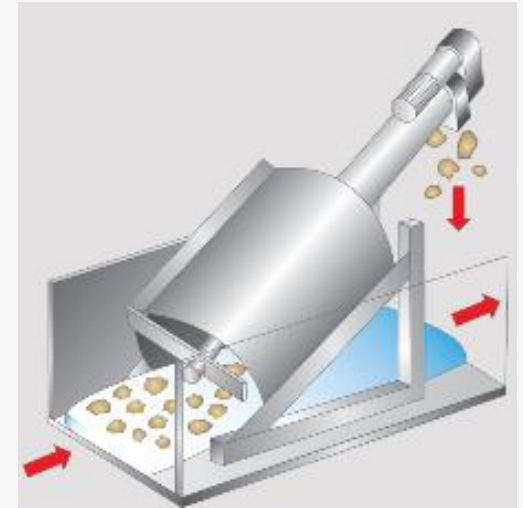
# Band Screens

<b>+</b> <b>Very Fine (2 mm)</b>	<b>-</b> <b>Gaps in Frame</b>
<b>Low Headroom</b>	<b>Size of solids</b>
<b>Easy to enclose</b>	<b>Brush &amp;/or Spray</b>
	<b>Needs Protection</b>
	<b>High headloss</b>



# Drum Screens

- **Submerged**
- **Above Ground**



# Submerged Drum Screens

<b>+</b> <b>Fine to very fine (1 – 2 mm)</b>	<b>-</b> <b>Size of solids</b>
<b>Low Headroom</b>	<b>Access to mechanical parts</b>
<b>Easy to enclose</b>	<b>Brush &amp;/or Spray</b>
	<b>Needs Protection</b>





# Above Ground Drum Screens

<b>+</b> <b>Very Fine</b> <b>(&lt;1 mm)</b>	<b>-</b> <b>High</b> <b>headloss</b>
<b>Can</b> <b>enclose</b>	<b>Pumped</b> <b>flow</b>
<b>Gravity</b> <b>flow</b> <b>through</b> <b>media</b>	<b>Spray &amp;/or</b> <b>Brush</b>



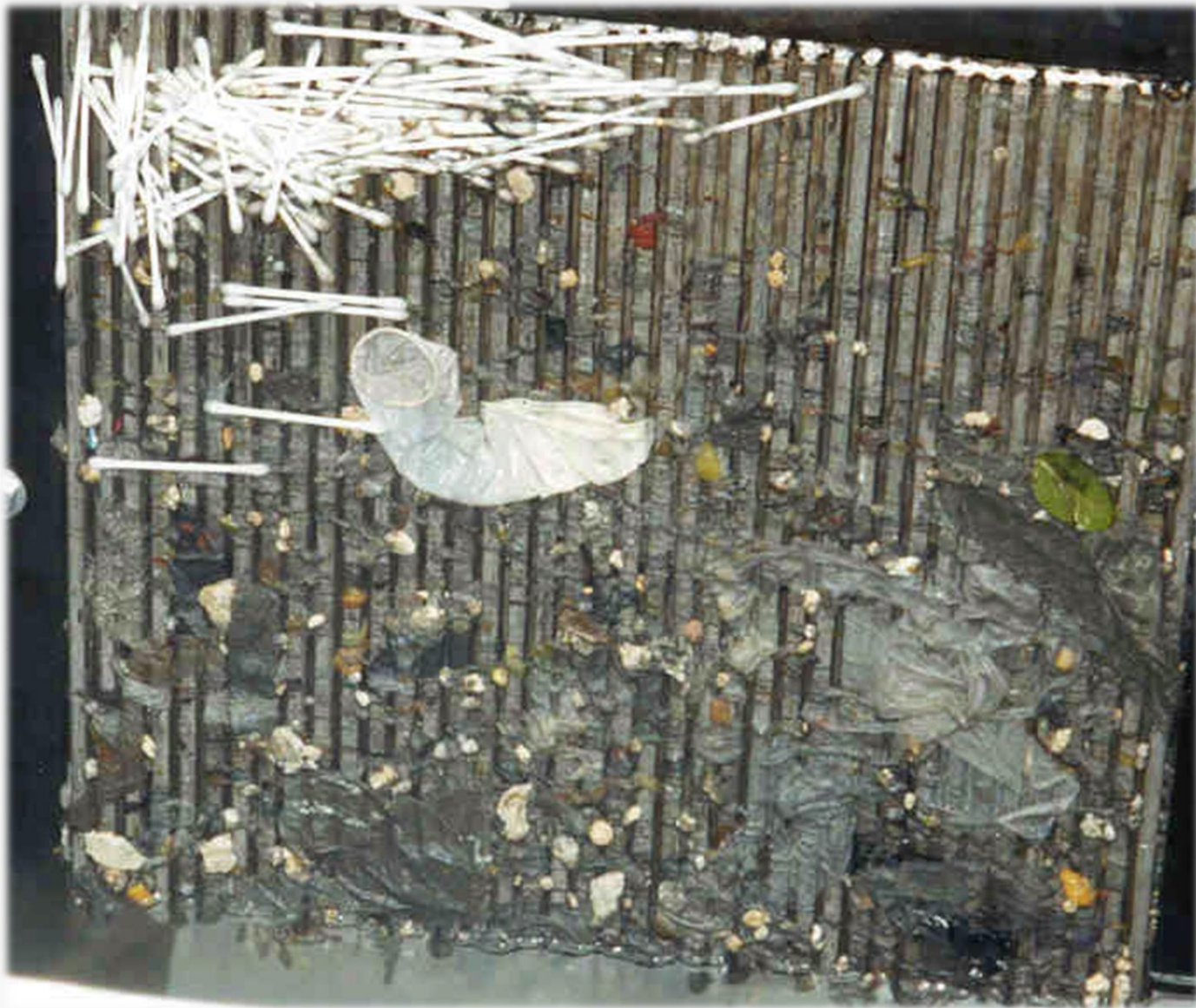


# Benefits of Fine Screening

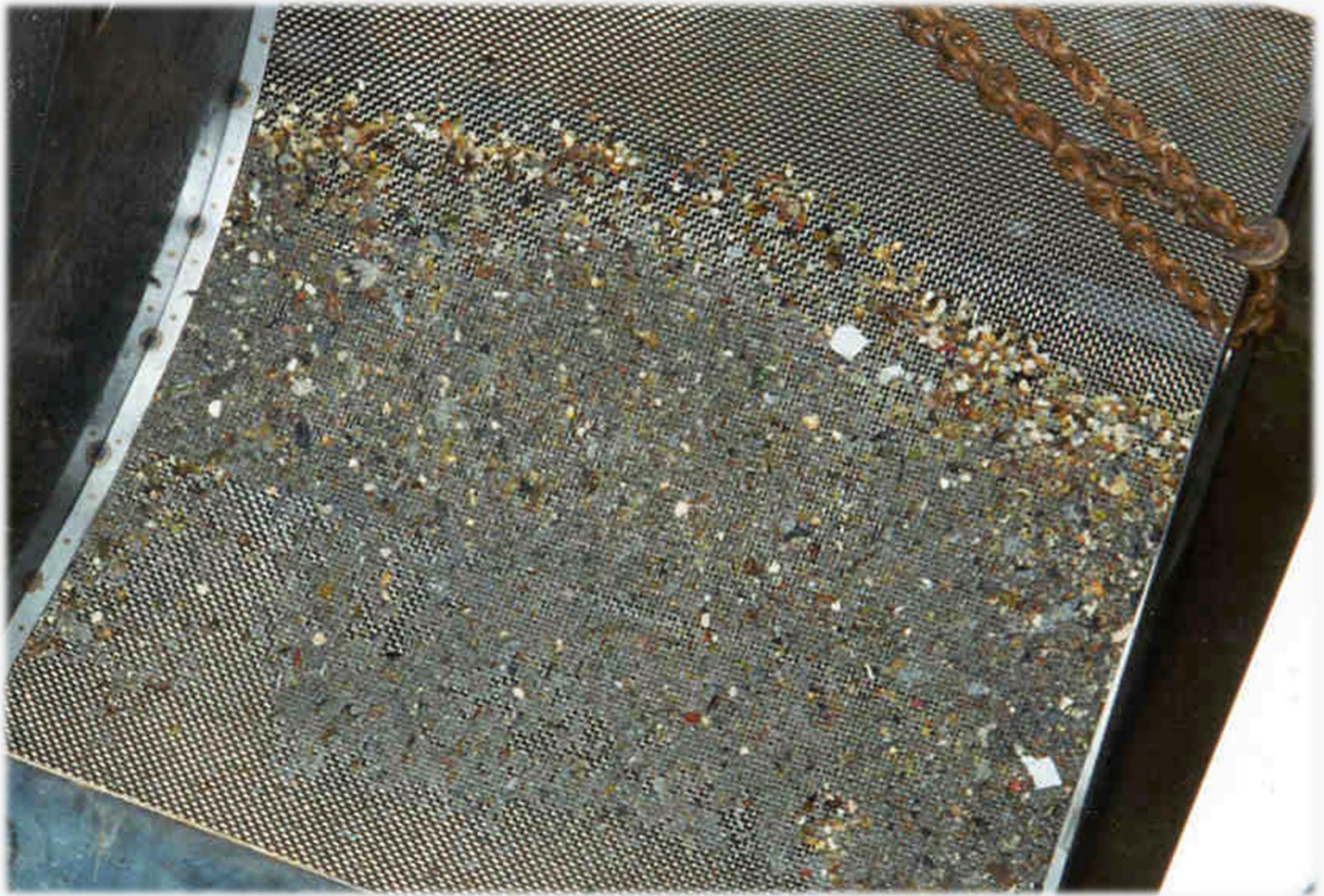
- **Remove troublesome solids**
- **Protect downstream processes and equipment**
- **Improve downstream processes**
- **Performance equivalent to primary clarifier**
- **Cleaner sludge and less volume**

# Consequences of Finer Screening

- **Complicated headworks**
- **Larger volume of solids**
- **More organics in screenings**
- **Increased costs**







# Evaluate Plant Needs

- **Maximize Opening**
- **Maximize Solids Capture**
- **Protect Downstream Process**
- **Minimize Maintenance**
- **Minimize Complexity**
- **Solids Handling Capability**



# Evaluate Equipment

Efficiency	Effectiveness
Design	Size
Screen Media	Opening
Materials	Cleaning
Headloss	Odors
Solids Handling	Durability

# Evaluate Headworks Design

- **Configuration of drainage system**
- **Complexity**
- **Solids handling and disposal**
- **Channel and building modifications**
- **Headloss**

# Evaluate Costs

- **Capital costs**
- **Replacement parts**
- **Maintenance**
- **Life-cycle**

**What type of headworks  
equipment does your plant  
really need?**



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