United States
Environmental Protection
Agency

Wastewater Technology Fact Sheet

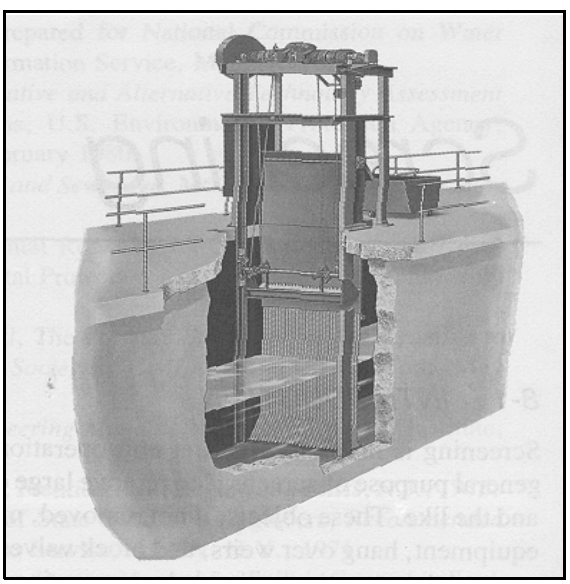
Screening and Grit Removal

DESCRIPTION

Wastewater contains large solids and grit that can interfere with treatment processes or cause undue mechanical wear and increased maintenance on wastewater treatment equipment. To minimize potential problems, these materials require separate handling. Preliminary treatment removes these constituents from the influent wastewater. Preliminary treatment consists of screening, grit removal, septage handling, odor control, and flow equalization. This fact sheet discusses screening and grit removal.

Screening

Screening is the first unit operation used at wastewater treatment plants (WWTPs). Screening removes objects such as rags, paper, plastics, and metals to prevent damage and clogging of downstream equipment, piping, and appurtenances. Some modern wastewater treatment plants use both coarse screens and fine screens. Figure 1 depicts a typical bar screen (a type of coarse screen).



Source: Qasim, 1994.

FIGURE 1 CABLE OPERATED BAR SCREEN

Coarse Screens

Coarse screens remove large solids, rags, and debris from wastewater, and typically have openings of 6 mm (0.25 in) or larger. Types of coarse screens include mechanically and manually cleaned bar screens, including trash racks. Table 1 describes the various types of coarse screens.

Fine Screens

Fine screens are typically used to remove material that may create operation and maintenance problems in downstream processes, particularly in systems that lack primary treatment. Typical opening sizes for fine screens are 1.5 to 6 mm (0.06 to 0.25 in). Very fine screens with openings of 0.2 to 1.5 mm (0.01 to 0.06 in) placed after coarse or fine screens can reduce suspended solids to levels near those achieved by primary clarification.

Comminutors and Grinders

Processing coarse solids reduces their size so they can be removed during downstream treatment operations, such as primary clarification, where both floating and settleable solids are removed. Comminuting and grinding devices are installed in the wastewater flow channel to grind and shred material up to 6 to 19 mm (0.25 to 0.75 in) in size.

Comminutors consist of a rotating slotted cylinder through which wastewater flow passes. Solids that are too large to pass through the slots are cut by blades as the cylinder rotates, reducing their size until they pass through the slot openings.

Grinders consist of two sets of counterrotating, intermeshing cutters that trap and shear wastewater solids into a consistent particle size, typically 6 mm (0.25 in). The cutters are mounted on two drive

TABLE 1 DESCRIPTION OF COARSE SCREENS

Screen Type	Description
Trash Rack	Designed to prevent logs, timbers, stumps, and other large debris from entering treatment processes. Opening size: 38 to 150 mm (1.5-6 in)
Manually Cleaned Bar Screen	Designed to remove large solids, rags, and debris. Opening size: 30 to 50 mm (1 to 2 in) Bars set at 30 to 45 degrees from vertical to facilitate cleaning. Primarily used in older or smaller treatment facilities, or in bypass channels.
Mechanically Cleaned Bar Screen	Designed to remove large solids, rags, and debris. Opening size: 6 to 38 mm (0.25 to 1.5 in). Bars set at 0 to 30 degrees from vertical. Almost always used in new installations because of large number of advantages relative to other screens.

Source: Design of Municipal Wastewater Treatment Plants, WEF MOP 8, Fourth Edition, 1998.

shafts with intermediate spacers. The shafts counterrotate at different speeds to clean the cutters. Figure 2 depicts a channel wastewater grinder.

The chopping action of the grinder reduces the formation of rag "balls" and rag "ropes" (an inherent problem with comminutors). Wastewaters that contain large quantities of rags and solids, such as prison wastewaters, utilize grinders downstream from coarse screens to help prevent frequent jamming and excessive wear.

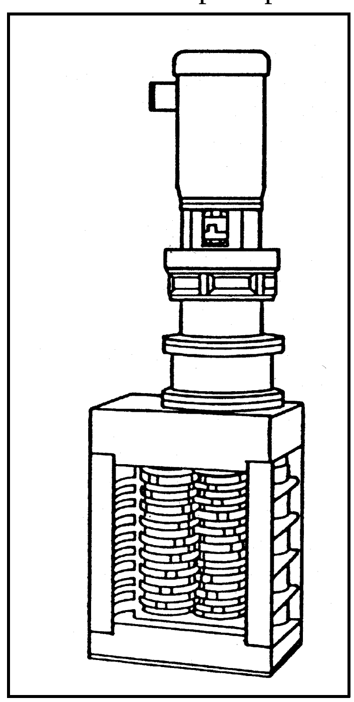
Grit Removal

Grit includes sand, gravel, cinder, or other heavy solid materials that are "heavier" (higher specific gravity) than the organic biodegradable solids in the wastewater. Grit also includes eggshells, bone chips, seeds, coffee grounds, and large organic particles, such as food waste. Removal of grit prevents unnecessary abrasion and wear of mechanical equipment, grit deposition in pipelines and channels, and accumulation of grit in anaerobic digesters and aeration basins. Grit removal facilities typically precede primary clarification, and follow screening and comminution. This prevents large solids from interfering with grit handling equipment. In secondary treatment plants without primary clarification, grit removal should precede aeration (Metcalf & Eddy, 1991).

Many types of grit removal systems exist, including aerated grit chambers, vortex-type (paddle or jet-induced vortex) grit removal systems, detritus tanks (short-term sedimentation basins), horizontal flow grit chambers (velocity-controlled channel), and hydrocyclones (cyclonic inertial separation). Various factors must be taken into consideration when selecting a grit removal process, including the quantity and characteristics of grit, potential adverse effects on downstream processes, head loss requirements, space requirements, removal efficiency, organic content, and cost. The type of grit removal system chosen for a specific facility should be the one that best balances these different considerations. Specifics on the different types of grit removal systems are provided below.

Aerated Grit Chamber

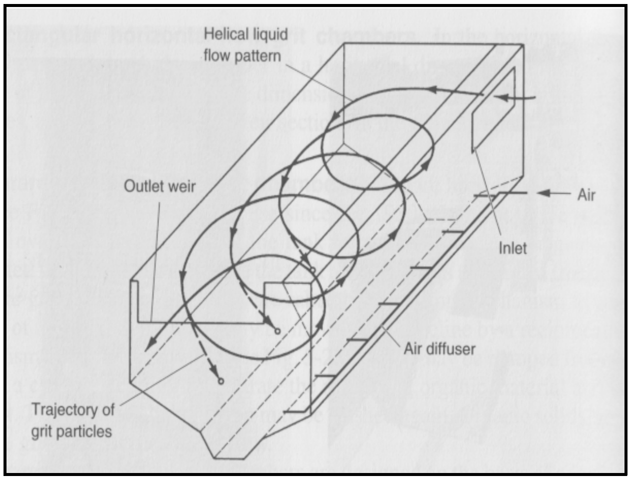
In aerated grit chambers, grit is removed by causing the wastewater to flow in a spiral pattern, as shown



Source: WEF, 1998.

FIGURE 2 WASTEWATER GRINDER: CHANNEL UNIT

in Figure 3. Air is introduced in the grit chamber along one side, causing a perpendicular spiral velocity pattern to flow through the tank. Heavier particles are accelerated and diverge from the streamlines, dropping to the bottom of the tank, while lighter organic particles are suspended and eventually carried out of the tank.



Source: Crites and Tchobanoglous, 1998.

FIGURE 3 AERATED GRIT CHAMBER

Vortex-Type Grit Chamber

The vortex-type grit chamber consists of a cylindrical tank in which the flow enters tangentially, creating a vortex flow pattern. Grit settles by gravity into the bottom of the tank (in a grit hopper) while effluent exits at the top of the tank. The grit that settles into the grit hopper may be removed by a grit pump or an air lift pump.

Detritus Tank

A detritus tank (or square tank degritter) is a constant-level, short-detention settling tank. These tanks require a grit-washing step to remove organic material. One design option includes a grit auger and a rake that removes and classifies grit from the grit sump.

Horizontal Flow Grit Chamber

The horizontal flow grit chamber is the oldest type of grit removal system. Grit is removed by maintaining a constant upstream velocity of 0.3 m/s (1 ft/s). Velocity is controlled by proportional weirs or rectangular control sections, such as Parshall flumes. In this system, heavier grit particles settle to the bottom of the channel, while lighter organic particles remain suspended or are resuspended and transported out of the channel. Grit is removed by a conveyor with scrapers, buckets, or plows. Screw conveyors or bucket elevators are used to elevate the grit for washing or disposal. In smaller plants, grit chambers are often cleaned manually.

Hydrocyclone

Hydrocyclone systems are typically used to separate grit from organics in grit slurries or to remove grit from primary sludge. Hydrocyclones are sometimes used to remove grit and suspended solids directly from wastewater flow by pumping at a head ranging from 3.7 to 9 m (12 to 30 ft). Heavier grit and suspended solids collect on the sides and bottom of the cyclone due to induced centrifugal forces, while scum and lighter solids are removed from the center through the top of the cyclone.

APPLICABILITY

Because various types of screening and grit removal devices are available, it is important that the proper design be selected for each situation. Though similarities exist between different types of equipment for a given process, an improperly applied design may result in an inefficient treatment process.

Screening

As discussed above, most large facilities use mechanically cleaned screening systems to remove larger materials because they reduce labor costs and they improve flow conditions and screening capture. Typically, only older or smaller treatment facilities use a manually cleaned screen as the primary or only screening device. A screening compactor is usually situated close to the mechanically cleaned screen and compacted screenings are conveyed to a dumpster or disposal area. However, plants utilizing mechanically cleaned screens should have a standby screen to put in operation when the primary screening device is out of service. This is standard design practice for most newly designed plants.

The use of fine screens in preliminary treatment has experienced a resurgence in the last 20 years. Such screens were a common feature before 1930 but their use diminished because of difficulty in cleaning oils and grease from the screens. In the early 1980s, fine screens regained popularity because of improved materials.

Communitors and Grinders

Comminutors and grinders are used primarily at smaller treatment facilities (less than 5 MGD) to process material between 6 and 19 mm (0.25 to 0.75 in) (WEF, 1998). This shredded material remains in the wastewater and is removed in downstream treatment processes.

Grit Removal

When selecting a grit removal process, the quantity and characteristics of grit and its potential to adversely affect downstream processes are important considerations. Other parameters to consider may include headloss requirements, space requirements, removal efficiency, organic content, and economics.

ADVANTAGES AND DISADVANTAGES

Advantages

Screening

Manually cleaned screens require little or no equipment maintenance and provide a good alternative for smaller plants with few screenings. Mechanically cleaned screens tend to have lower labor costs than manually cleaned screens and offer the advantages of improved flow conditions and screening capture over manually cleaned screens.

Communitors and Grinders

A major advantage of using communitors and grinders is that removal of grit reduces damage and maintenance to downstream processes. Comminutors and grinders also eliminate screenings handling and disposal, which may improve the aesthetics of the plant, reducing odors, flies, and the unsightliness associated with screenings. Some recently developed grinders can chop, remove, wash, and compact the screenings. The use of comminutors in cold weather eliminates the need to prevent collected screenings from freezing. Comminutors and grinders typically have a lower profile than screens, so cost savings can be significant when the units must be enclosed.

Grit Removal

Aerated Grit Chamber

Some advantages of aerated grit chambers include:

- Consistent removal efficiency over a wide flow range.
- A relatively low putrescible organic content may be removed with a well controlled rate of aeration.
- Performance of downstream units may be improved by using pre-aeration to reduce septic conditions in incoming wastewater.
- Aerated grit chambers are versatile, allowing for chemical addition, mixing, pre-aeration, and flocculation.

Vortex-Type Grit Chamber

- These systems remove a high percentage of fine grit, up to 73 percent of 140-mesh (0.11 mm/0.004 in diameter) size.
- Vortex grit removal systems have a consistent removal efficiency over a wide flow range.
- There are no submerged bearings or parts that require maintenance.
- The “footprint” (horizontal dimension) of a vortex grit removal system is small relative to other grit removal systems, making it advantageous when space is an issue.
- Headloss through a vortex system is minimal, typically 6 mm (0.25 in). These systems are also energy efficient.

Detritus Tank

Detritus tanks do not require flow control because all bearings and moving mechanical parts are above the water line. There is minimal headloss in this type of unit.

Horizontal Flow Grit Chamber

Horizontal flow grit chambers are flexible because they allow performance to be altered by adjusting the outlet flow control device. Construction is not complicated. Grit that does not require further classification may be removed with effective flow control.

Hydrocyclone

Hydrocyclones can remove both grit and suspended solids from wastewater. A hydrocyclone can potentially remove as many solids as a primary clarifier.

Disadvantages

Screening

Manually cleaned screens require frequent raking to avoid clogging and high backwater levels that cause buildup of a solids mat on the screen. The increased raking frequency increases labor costs. Removal of this mat during cleaning may also cause flow surges that can reduce the solids-capture efficiency of downstream units. Mechanically cleaned screens are not subject to this problem, but they have high equipment maintenance costs.

Communitors and Grinders

Comminutors and grinders can create problems for downstream processes, such as increasing plastics buildup in digestion tanks or rag accumulation on air diffusers. In addition, solids from comminutors and grinders will not decompose during the digestion process. If these synthetic solids are not removed, they may cause biosolids to be rejected for reuse as a soil amendment.

Grit Removal

Grit removal systems increase the headloss through a wastewater treatment plant, which could be problematic if headloss is an issue. This could require additional pumping to compensate for the headloss.

The following paragraphs describe the specific disadvantages of different types of grit removal systems.

Aerated Grit Chamber

Potentially harmful volatile organics and odors may be released from the aerated grit chamber. Aerated grit chambers also require more power than other grit removal processes, and maintenance and control of the aeration system requires additional labor.

Vortex-Type Grit Chamber

- Vortex grit removal systems are usually of a proprietary design, which makes modifications difficult.
- Paddles tend to collect rags.
- Vortex units usually require deep excavation due to their depth, increasing construction costs, especially if unrippable rock is present.
- The grit sump tends to clog and requires high-pressure agitation using water or air to loosen grit compacted in the sump.

Detritus Tank

- Detritus tanks have difficulty achieving uniform flow distribution over a wide range of flows because the inlet baffles cannot be adjusted.
- This type of removal system removes large quantities of organic material, especially at low flows, and thus requires grit washing and classifying.

- Grit may be lost in shallow installations (less than 0.9 m [3 ft]) due to the agitation created by the rake arm associated with this system.

Horizontal Flow Grit Chamber

- It is difficult to maintain a 0.3 m/s (1 ft/s) velocity over a wide range of flows.
- The submerged chain, flight equipment, and bearings undergo excessive wear.
- Channels without effective flow control will remove excessive amounts of organic material that require grit washing and classifying.
- Head loss is excessive (typically 30 to 40 percent of flow depth).
- High velocities may be generated at the channel bottom with the use of proportional weirs, leading to bottom scour.

Hydrocyclone

Hydrocyclones require energy because they use a pump to remove grit and suspended solids. Coarse screening is required before these units to remove sticks, rags, and plastics.

DESIGN CRITERIA

Screening

Screening devices are classified based on the size of the material they remove (the screenings). The "size" of screening material refers to its diameter. Table 2 lists the correlation between screening sizes and screening device classification.

In addition to screening size, other design considerations include the depth, width, and approach velocity of the channel; the discharge height, the screen angle; wind and aesthetic considerations; redundancy; and head loss.

Table 3 lists typical design criteria for mechanically cleaned bar rack type screens.

TABLE 2 SCREENING DEVICE CLASSIFICATION

Screening Device Classification	Size Classification/Size Range of Screen Opening
Bar screen	
Manually Cleaned	Coarse/25-50 mm (1-2 in)
Mechanically Cleaned	Coarse/15-75 mm (0.6-3.0 in)
Fine bar or perforated coarse screen (mechanically cleaned)	
Fine Bar	Fine Coarse/3-12.5 mm (0.1-0.5 in)
Perforated Plate	Fine Coarse/3-9.5 mm (0.1-0.4 in)
Rotary Drum	Fine Coarse/3-12.5 mm (0.1-0.5 in)
Fine screen (mechanically cleaned)	
Fixed Parabolic	Fine/0.25-3.2 mm (0.01-0.13 in)
Rotary Drum	Fine/0.25-3.2 mm (0.01-0.13 in)
Rotary Disk	Very fine (micro)/0.15-0.38 mm (0.01-0.02 in)

Source: Crites and Tchobanoglous, 1998.

The use of fine screens produces removal characteristics similar to primary sludge removal in primary sedimentation. Fine screens are capable of removing 20 to 35 percent suspended solids and BOD_5. Fine screens may be either fixed or movable, but are permanently set in a vertical, inclined, or horizontal position and must be cleaned by rakes, teeth, or brushes.

Communitors and Grinders

Figure 4 depicts a typical comminutor. When designing a comminutor, headloss should be considered. Headloss through a comminutor is usually in the range of a few centimeters to 0.9 m (3 ft). Therefore, the manufacturer's ratings should be decreased by 70 to 80 percent to account for clogging of the screen, since manufacturer's headloss characteristics are usually based on clean water flow (Crites and Tchobanoglous, 1998).

TABLE 3 DESIGN CRITERIA FOR MECHANICALLY CLEANED BAR SCREENS

Item	Design Criteria	
	Metric Units	English Units
Bar width	5-15 mm	0.2-0.6 in
Bar depth	25-40 mm	1.0-1.5 in
Clear spacing between bars	15-75 mm	0.6-3.0 in
Slope from vertical	0-30 degrees	0-30 degrees
Approach velocity	0.6-1.0 m/s	2.0-3.25 ft/s
Allowable Headloss	150 mm	6 in

Source: WEF, 1998.

When a comminution device is installed upstream of a grit removal device, the teeth of the comminutor are subject to high wear and tear. Rock traps are recommended to prolong the life of the comminutor. In addition, a bypass manual bar rack should be installed in the event that flow rates exceed the comminutor capacity or there is a mechanical failure.

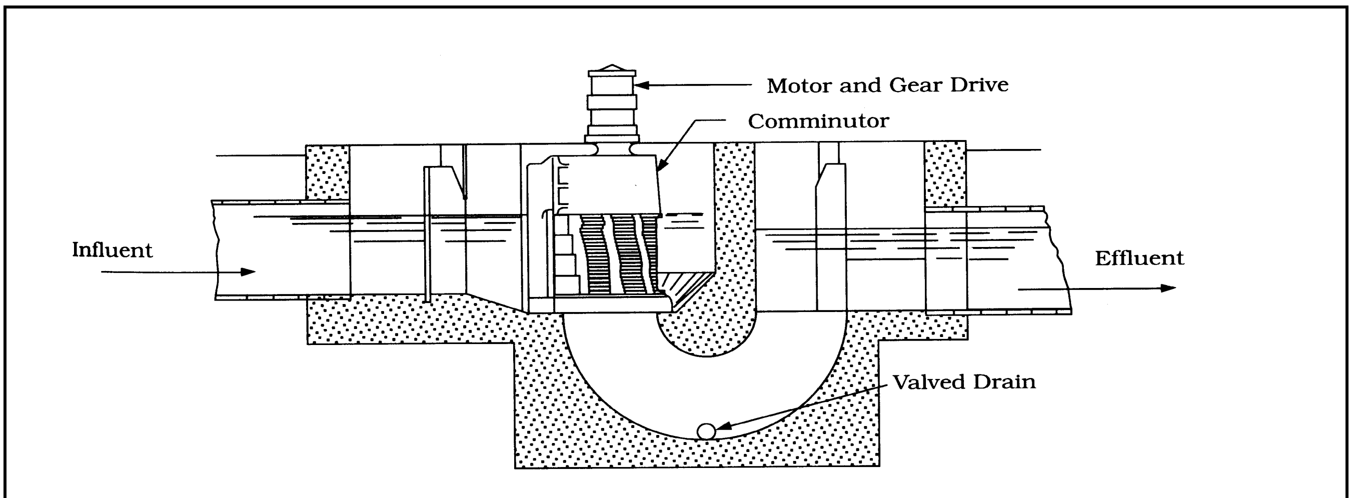
Grit Removal

With respect to grit removal systems, grit is traditionally defined as particles larger than 0.21 mm (0.008 in) (65 mesh) and with a specific gravity of greater than 2.65 (U.S. EPA, 1987). Equipment design was traditionally based on removal of 95 percent of these particles. However, with the recent recognition that smaller particles must be removed to avoid damaging downstream processes, many modern grit removal designs are capable of removing up to 75 percent of 0.15 mm (0.006 in) (100 mesh) material.

Aerated Grit Chamber

Aerated grit chambers are typically designed to remove particles of 70 mesh (0.21 mm/0.008 in) or larger, with a detention period of two to five minutes at peak hourly flow. When wastewater flows into the grit chamber, particles settle to the bottom according to their size, specific gravity, and the velocity of roll in the tank. A velocity that is too high will result in lower grit removal efficiencies, while a velocity that is too low will result in increased removal of organic materials. Proper adjustment of air velocity will result in nearly 100 percent removal of the desired particle size and a well-washed grit.

Design considerations for aerated grit chambers include the following (WEF 1998):



Source: Reynolds/Richards, 1996.

FIGURE 4 TYPICAL COMMINUTOR INSTALLATION

- Air rates typically range from 0.3 to 0.7 $m^3/m \cdot min$ (3 to 8 $ft^3/ft \cdot min$) of tank length.

- A typical minimum hydraulic detention time at maximum instantaneous flow is two minutes.

- Typical length-to-width ratio is 2.5:1 to 5:1.

- Tank inlet and outlet are positioned so the flow is perpendicular to the spiral roll pattern.

- Baffles are used to dissipate energy and minimize short circuiting.

Vortex-Type Grit Chamber

Two designs of vortex grit units exist: chambers with flat bottoms and a small opening to collect grit; and chambers with a sloping bottom and a large opening into the grit hopper. Flow into a vortex-type grit system should be straight, smooth, and streamlined. The straight inlet channel length is typically seven times the width of the inlet channel, or 4.6 m (15 ft), whichever is greater. The ideal velocity range in the influent is typically 0.6 to 0.9 m/s (2 to 3 ft/s) at 40 to 80 percent of peak flow. A minimum velocity of 0.15 m/s (0.5 ft/s) should be maintained at all times, because lower velocities will not carry grit into the grit chamber (WEF, 1998).

Detritus Tank

Detritus tanks are designed to keep horizontal velocity and turbulence at a minimum while maintaining a detention time of less than one minute. Proper operation of a detritus tank depends on well-distributed flow into the settling basin. Allowances are made for inlet and outlet turbulence as well as short circuiting by applying a safety factor of 2.0 to the calculated overflow rate.

Horizontal Flow Grit Chamber

Horizontal flow grit chambers use proportional weirs or rectangular control sections to vary the depth of flow and keep the velocity of the flow stream at a constant 0.3 m/s (1 ft/s). The length of the grit chamber is governed by the settling velocity of the target grit particles and the flow control section-depth relationship. An allowance for inlet and outlet turbulence is added. The cross sectional area of the channel is determined by the rate of flow and the number of channels. Allowances are made for grit storage and grit removal equipment. Table 4 lists design criteria for horizontal flow grit chambers.

TABLE 4 HORIZONTAL FLOW GRIT CHAMBER DESIGN CRITERIA

Item	Design Criteria: Range Metric (English)	Design Criteria: Typical Metric (English)
Detention time	45-90 s	60 s
Horizontal velocity	0.24-0.4 m/s (0.8-1.3 ft/s)	0.3 m/s (1.0 ft/s)
Settling velocity[1]:		
50-mesh	2.8-3.1 m/min (9.2-10.2 ft/min)	2.9 m/min (9.6 ft/min)
100-mesh	0.6-0.9 m/min (2.0-3.0 ft/min)	0.8 m/min (2.5 ft/min)
Headloss (% of channel depth)	30-40%	36%[2]
Inlet and outlet length allowance	25-50%	30%

[1]If the specific gravity of the grit is significantly less than 2.65, lower velocities should be used.
[2]For Parshall flume control.

Source: Crites and Tchobanoglous, 1998.

PERFORMANCE

The use of screening and grit removal systems is well documented. The performance of bar screens varies depending on the spacing of the bars. Table 5 lists typical screening quantities for various screen sizes.

The quantity of screenings depends on the length and slope of the collection system and the presence of pumping stations. When the collection system is long and steep or when pumping stations exist, fewer screenings are produced because of disintegration of solids. Other factors that affect screening quantities are related to flow, as quantities generally increase greatly during storm flows. Peak

TABLE 5 SCREENING REMOVAL QUANTITIES

Screen Size	Screenings Quantity	
	$m^3/10^6$ m^3	ft^3/Mgal
13 mm (0.5 in)	60	8
38 mm (1.5 in)	11.2	1.5

Source: Reynolds and Richards, 1996.

daily removals may vary by a 20:1 ratio on an hourly basis from average flow conditions. Combined collection systems may produce several times the coarse screenings produced by separate collection systems.

Given the complexity of collection systems and types of materials that may be considered "grit," the quantity and characteristics of grit removed from wastewater will vary. Grit quantity is influenced by the type and condition of the collection system, the characteristics of the drainage area, garbage disposal methods, the slope of the collection system, and the efficiency of the grit removal system. The quantity of grit may vary from 0.004 to 0.21 $m^3/10^3m^3$ (0.5 to 30 ft^3/Mgal) (Crites and Tchobanoglous, 1998). The performance of a grit removal system may be enhanced if actual plant data is used when designing a new grit removal system.

Table 6 depicts quantities of screenings and grit from various wastewater treatment plants. There are no obvious trends associated with design flow through a plant and grit and screenings removal quantities. Differences in wastewater characteristics and equipment efficiencies make a correlation between flow and quantities of screenings and grit removed nearly impossible.

OPERATION AND MAINTENANCE

Screening

Manually cleaned screens require frequent raking to prevent clogging. Cleaning frequency depends on the characteristics of the wastewater entering a plant. Some plants have incorporated screening devices, such as basket-type trash racks, that are manually hoisted and cleaned. Mechanically cleaned screens usually require less labor for operation than manually cleaned screens because screenings are raked with a mechanical device rather than by facility personnel. However, the rake teeth on mechanically cleaned screens must be routinely inspected because of their susceptibility to breakage and bending. Drive mechanisms must also be frequently inspected to prevent fouling due to grit and rags. Grit removed from screens must be disposed of regularly.

TABLE 6 GRIT AND SCREENINGS REMOVAL QUANTITIES AT VARIOUS PLANTS

Plant Location	Flow, m^3/d (MGD)	Grit, $m^3/10^3m^3$ (ft^3/Mgal)	Screenings, $m^3/10^3m^3$ (ft^3/Mgal)[a]
Uniontown, Pennsylvania	11,400 (3.0)	0.074 (10.5)	0.006 (0.9)
East Hartford, Connecticut	15,100 (4.0)	0.017 (2.4)	0.009 (1.33)
Duluth, Minnesota	45,400 (12.0)	0.006 (0.8)	0.004 (0.56)
Lamberts Point Water Pollution Control Plant, Norfolk, Virginia	75,700 (20.0)	0.034 (4.85)	0.009 (1.20)
Village Creek Wastewater Treatment Plant, Ft. Worth, Texas	170,000 (45.0)	0.009 (1.29)	0.005 (0.72)
County of Milwaukee, Wisconsin, South Shore	454,000 (120.0)	0.003 (0.48)	0.004 (0.60)
Twin Cities Metro Wastewater Treatment Plant, Minnesota	825,000 (218.0)	0.034 (4.82)	0.008 (1.15)
Chicago, Illinois (Northside)	1,260,000 (333.0)	0.003 (0.41)	0.006 (0.83)

[a]ft^3/Mgal=cubic feet per million gallons

Source: WEF, 1998.

Communitors and Grinders

Comminutors can create operation and maintenance problems in downstream processes. While shredding solids eliminates the problem of handling screening materials at the head of the plant, problems inherent to the use of communitors, such as the decreased quality of digested biosolids and the accumulation of rags on air diffusers, have lessened the popularity of this technology. Comminutors are generally avoided in new designs and are being removed from many existing plants. Grinders are greatly affected by grit and other solids. As such, they require routine inspection every six months and replacement of bearings and cutter teeth every one to three years.

Grit Removal

Collected grit must be removed from the chamber, dewatered, washed, and conveyed to a disposal site. Some smaller plants use manual methods to remove grit, but grit removal is usually accomplished by an automatic method. The four methods of automatic grit removal include inclined screw or tubular conveyors, chain and bucket elevators, clamshell buckets, and pumping. A two-step grit removal method is sometimes used, where grit is conveyed horizontally in a trough or channel to a hopper, where it is then elevated from the hopper to another location.

Aerated grit chambers use a sloped tank bottom in which the air roll pattern sweeps grit along the bottom to the low side of the chamber. A horizontal screw conveyor is typically used to convey settled grit to a hopper at the head of the tank. Another method to remove grit from the chamber floor is a chain and flight mechanism.

Once removed from the chamber, grit is usually washed with a hydrocyclone or grit classifier to ease handling and remove organic material. The grit is then conveyed directly to a truck, dumpster, or storage hopper. From there, the grit is taken to a landfill or other disposal facility.

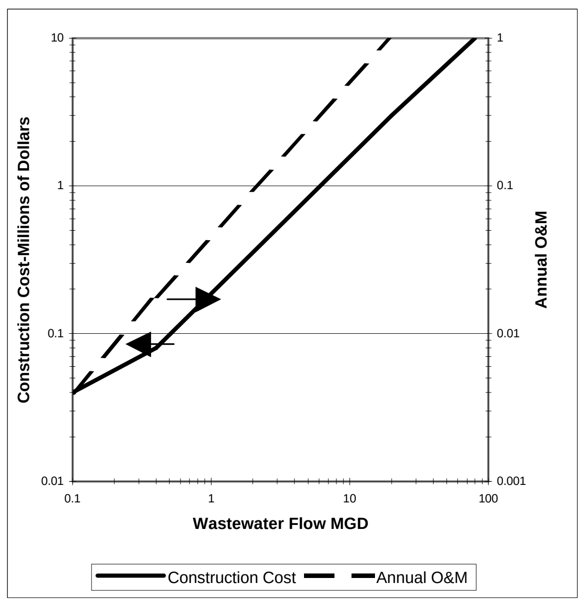
COSTS

The cost of screens and grit removal systems varies depending on the type of technology used, ancillary equipment, and applicability of various technologies to different situations.

Graphs can be used to relate average wastewater flow through a plant to a specific technology. Figure 5 shows a graph relating wastewater flow to the cost of a horizontal shaft rotary screen. Costs include construction, operation, and maintenance. Contractor bids on a recent wastewater project ranged from $150,000 to $400,000 for Rotary Drum Screenings Removal and from $150,000 to $208,800 for Vortex-type Grit Removals. Generally, equipment costs will be close for each bid. However, the overall costs vary for each treatment process/project because of differences in construction approaches by the contractors.

REFERENCES

Other Related Fact Sheets



Source: Martin, 1991.

FIGURE 5 COST CURVE FOR HORIZONTAL SHAFT ROTARY SCREEN

Sewer Lift Station
EPA 832-F-00-073
September 2000

Sewer Cleaning & Inspection
EPA 832-F-99-031
September 1999

Screens
EPA 832-F-99-040
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owm/mtb/mtbfact.htm

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5. Urquhart, L., 1962. *Civil Engineering*. Costs include construction, operation, and maintenance. Specific cost data from contractor bids.

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ADDITIONAL INFORMATION

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Fort Lauderdale, FL 33340-8399

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Link-Belt Headworks Products
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Chalfont, PA 18914

Office of Water
EPA 832-F-03-011
June 2003

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