CE 370

Screens

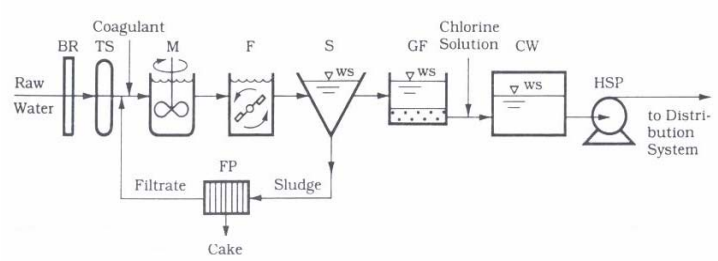


Figure 1. Water Treatment Plant

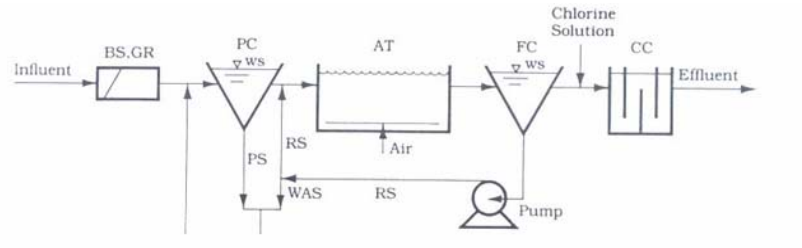
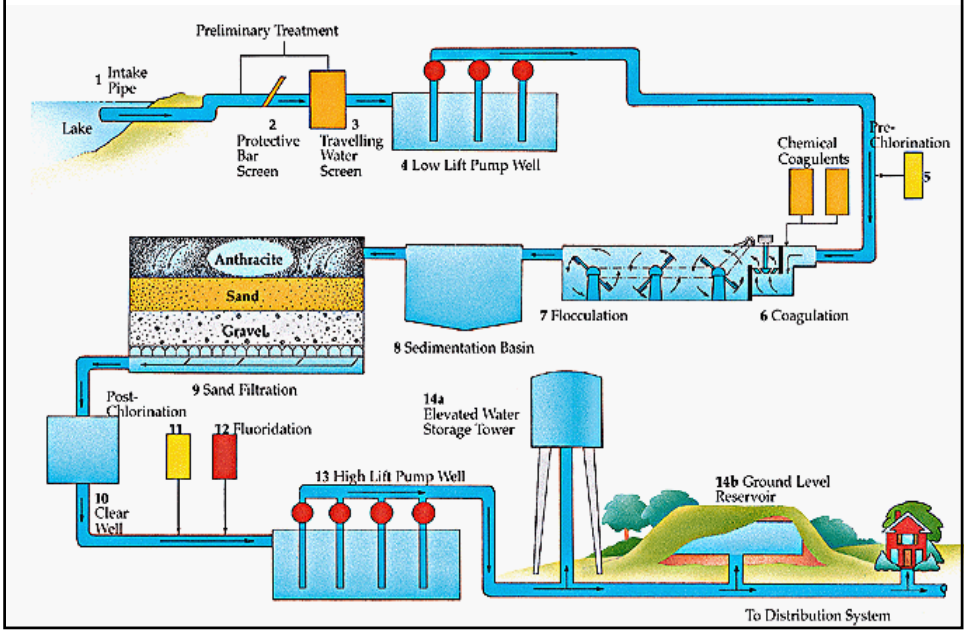
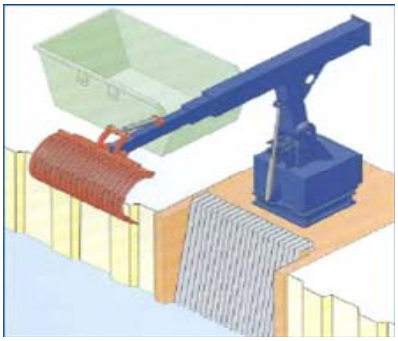


Figure 2. Wastewater Treatment Plant

Water Treatment Plant



Screens



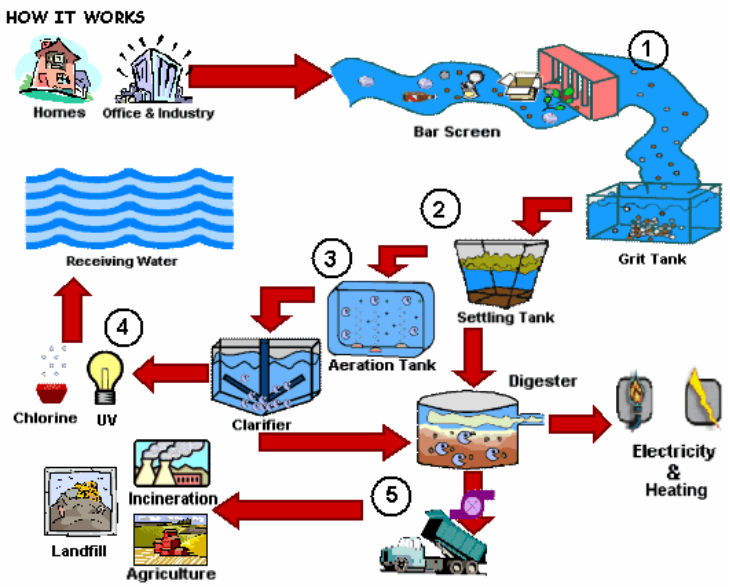
Coarse Bar Screens

Traveling Screen

Water Treatment

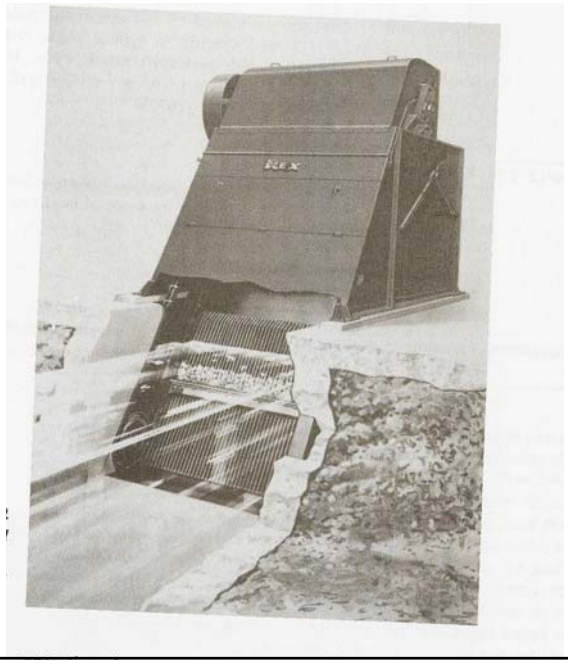
- Coarse Bar Racks (Screens)
  - Clear space between bars is up to 3 inches (75 mm)
  - Are used to retain large objects into water intake
- Traveling Racks (Screens)
  - Located behind bar racks
  - Have openings of 3/8 to ½ inch (10-13 mm)
  - Are used to prevent small particles

Wastewater Treatment Plant



Wastewater Treatment

- Manually cleaned screens
- Mechanically cleaned screens



Manually Cleaned Bar Screens

- Space between bars are 1 to 2 inches (25 to 50 mm)
- Mounted at 30 to 75° angle to horizontal (typically 30 to 45°)

Mechanically Cleaned Bar Screens

- Bar spacing is 0.5 to 1.5 inches (12 to 38 mm)
- Mounted at 45 to 90° with horizontal (typically 60°)
- Cleaning is performed at time intervals or when the head loss reaches a certain value (2 inches or 50 mm)

Design Parameters

- The approach channel should be straight for at least 0.6 meter ahead of the screen to produce uniform flow through the screen
- Approach velocity should be at least 1.5 ft/sec (0.46 m/s) to prevent precipitation of debris
- Velocity through bars should be less than 2 ft/sec (0.62 m/s) at design flow
- Velocity through bars should be not more than 3 ft/sec (0.91 m/s) at maximum flow

Design Parameters

- At least two screens should be provided (one stand-by screen)
- Stop-gates slots are provided ahead and behind screens for maintenance reasons

Design Equations

- Head-loss across bar screens can be represented by:

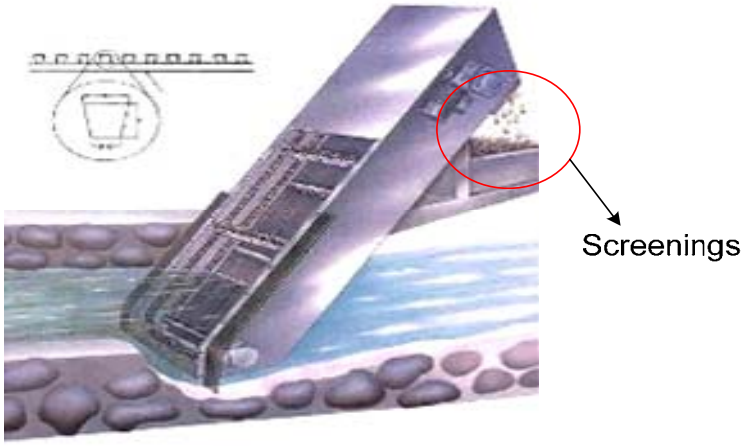
$$h_L = \frac{(V_b^2 - V_a^2)}{2g} \times \frac{1}{0.7}$$

- h_L = head loss, ft (m)
- V_a = approach velocity ft/sec (m/s)
- V_b = velocity through bar openings ft/sec (m/s)
- g = acceleration due to gravity

Screenings

- Amount
  - For ½ inch spacing = 8 ft^3 (60 m^3) per million gallons (million m^3) of treated wastewater
  - For 1.5 inch spacing = 1.5 ft^3 (11.2 m^3) per million gallons (million m^3) of treated wastewater
- Management
  - Disposed in landfills

Screenings



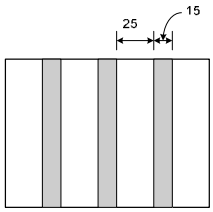
Traveling Screen

Example

- A mechanical bar screen is to be used in an approach channel with a maximum velocity of 1 m/s. The bars are 15 mm thick, and the openings are 25 mm wide. Determine:
  - The velocity between the bars
  - The head loss in meters

Solution

- Assume the channel has a width (W) and depth (D)
- Net area of screen = WD [25 / (25+15) = (5/8)WD
- Area of channel = WD
- Use continuity equation



- $V_a A_a = V_b A_b$ OR $V_b = \frac{V_a A_a}{A_b}$

$$V_b = \frac{1 \times WD}{(5/8)WD} = 1.6 \text{ m/s}$$

Solution

- Head Loss

$$h_L = \frac{(V_b^2 - V_a^2)}{2g} \times \frac{1}{0.7}$$

$$h_L = \frac{(1.6)^2 - 1^2}{2g} \times \frac{1}{0.7} = 0.114m$$

Shredding

- Why ?
  - Reduce size of particles
- How ?
  - Grinders
  - Barminutors
  - comminutors
- Fate of shredded solids
  - Return to wastewater flow downstream from screens

Comminutor Installation