Chapter 4: Racks, Screens, Comminutors and Grit Removal

King County
DNRP/WTD

Sacramento State
Redefine the Possible

(Revision 1, JAN 2019)

Words

DETRITUS (dee-TRY-tus) - Also called GRIT

The heavy material present in wastewater such as sand, coffee grounds, eggshells, gravel and cinders.

Words

COMMINUTION (kom-mih-NEW-shun)

A mechanical treatment process that cuts large pieces of wastes into smaller pieces so that they will not plug pipes or damage equipment. Comminution and SHREDDING usually mean the same thing.

Words

HEAD LOSS

The head pressure or energy (they are the same) lost by water flowing in a pipe or channel as a result of friction loss or a restriction in the flow path.

Words

PRELIMINARY TREATMENT

The removal of metal, rocks, rags, sand, egg shells and similar materials that may hinder the operation of a treatment plant. Preliminary treatment is accomplished by using equipment such as racks, bar screens, Comminutors and grit removal systems.

Words

SAFETY

The Wastewater Treatment industry has a higher accident rate than most other industries – reported by the National Safety Council.

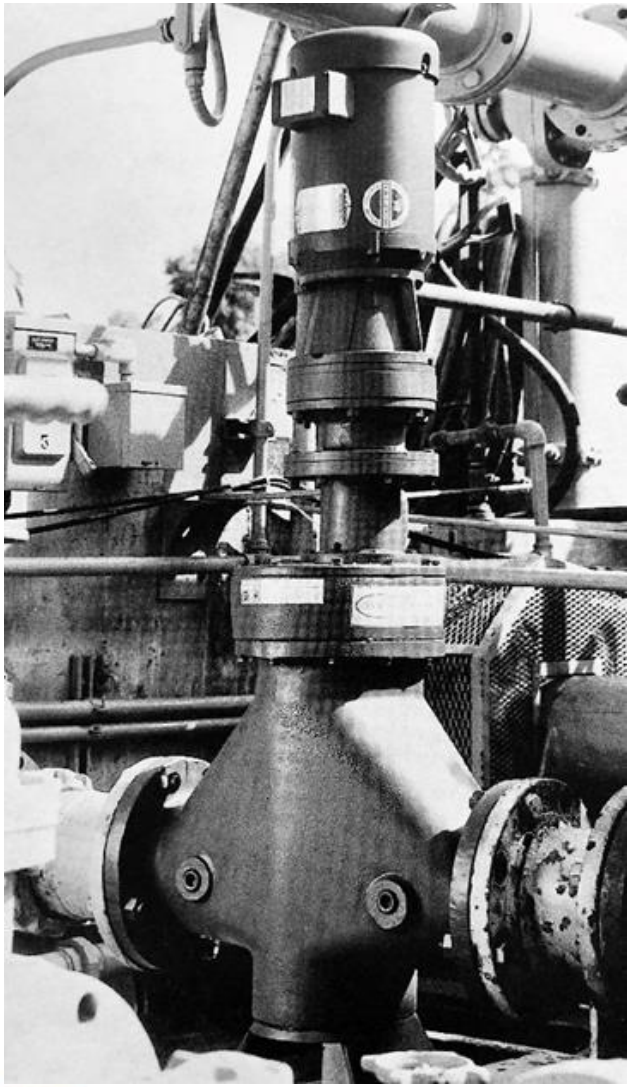
Words

COMMINUTOR

Comminutors are devices that act both as a cutter and a SCREEN. Their purpose is to shred (comminute) the solids and leave them in the wastewater.

Words

Words

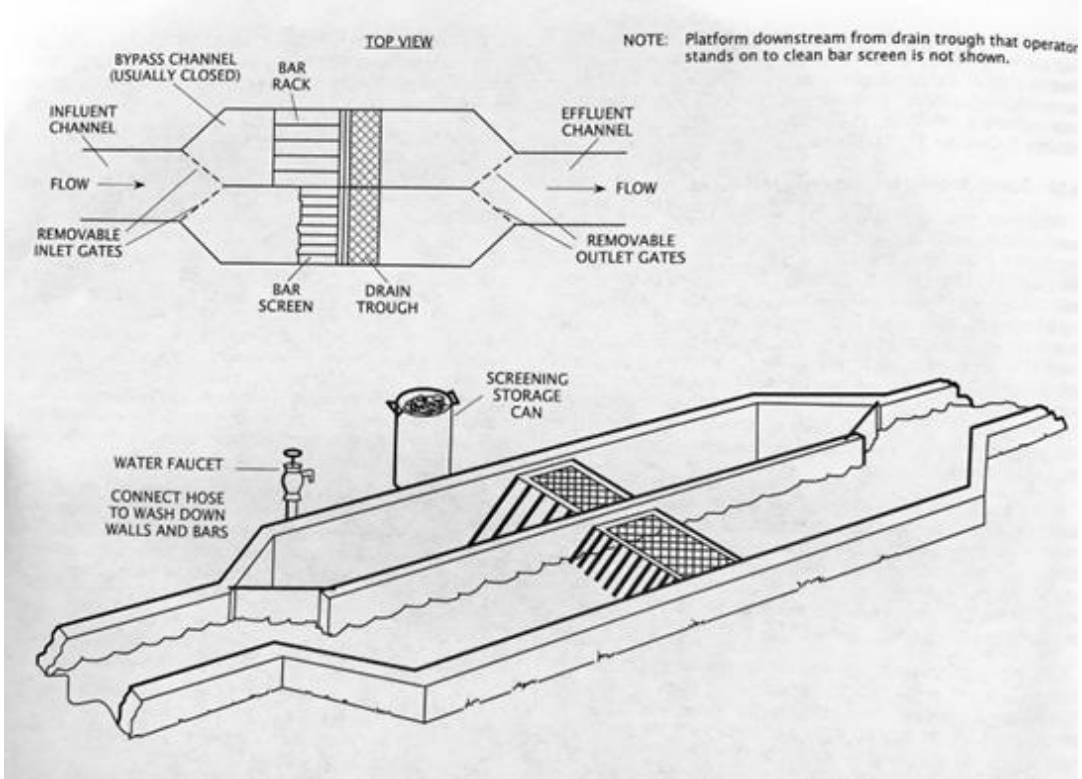


Words

RACKS and SCREENS

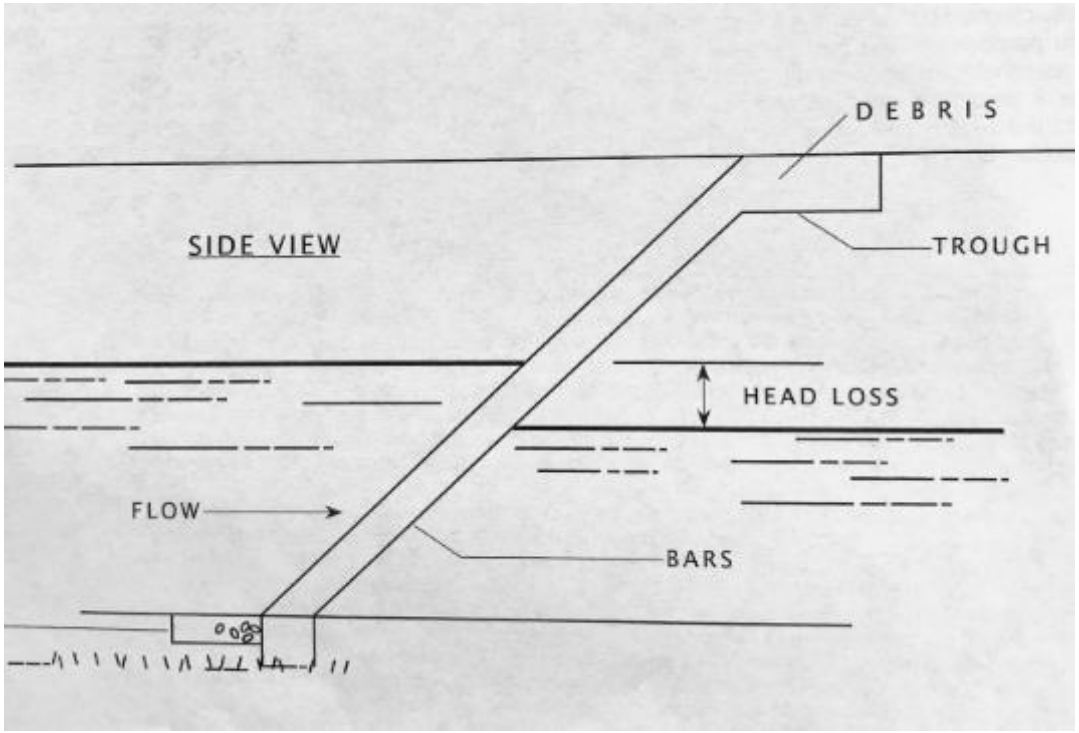
Removes the larger debris (rocks, bottles, cans, metal, rags toys, bricks…) that could otherwise plug pipes and can plug or damage pumps.

Process Description



Mechanically Cleaned Bar Screen - Operational Strategies

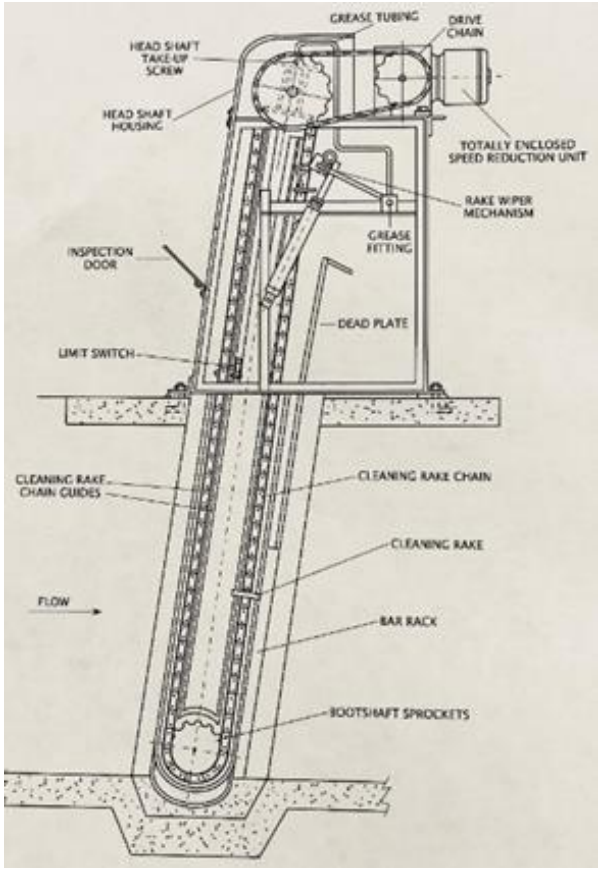
Process Description



Manually Cleaned Bar Screen – Operation

Process Description

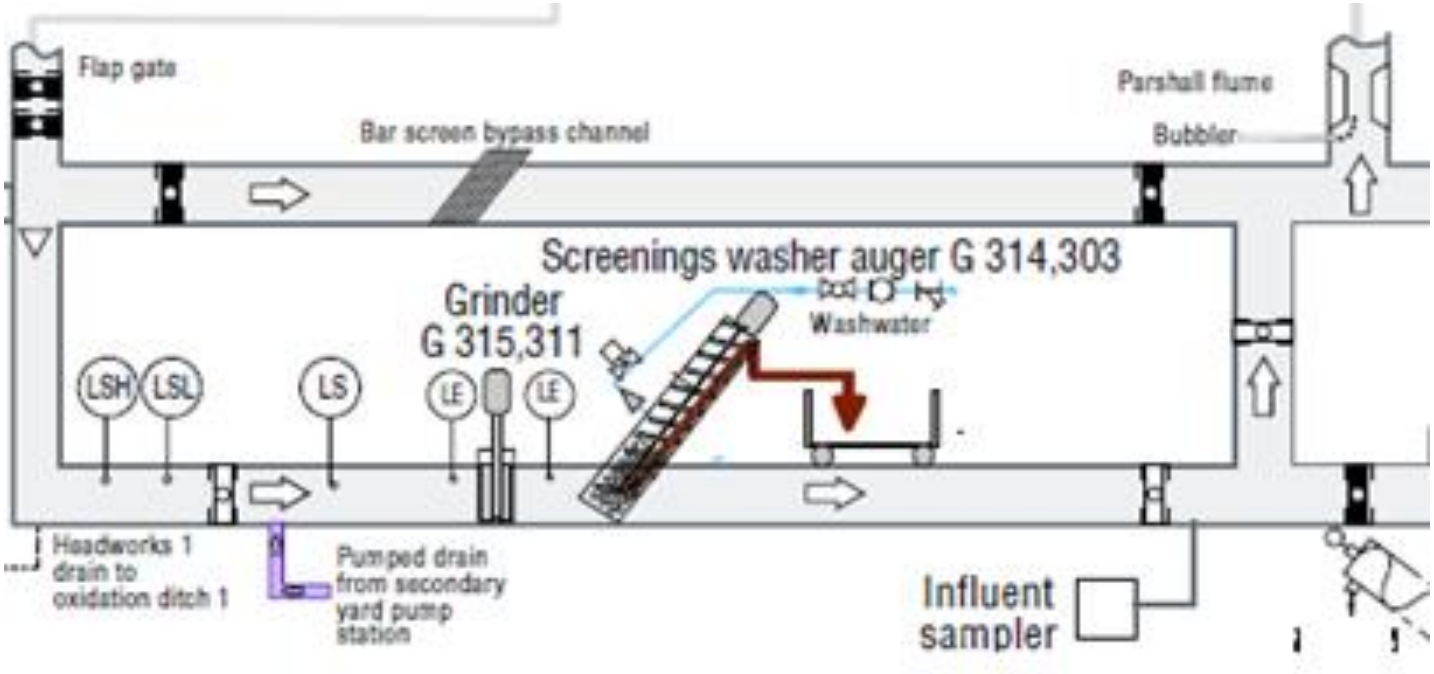
Vashon



Vashon - Grinder and ¼ inch rotary screen auger

Process Description

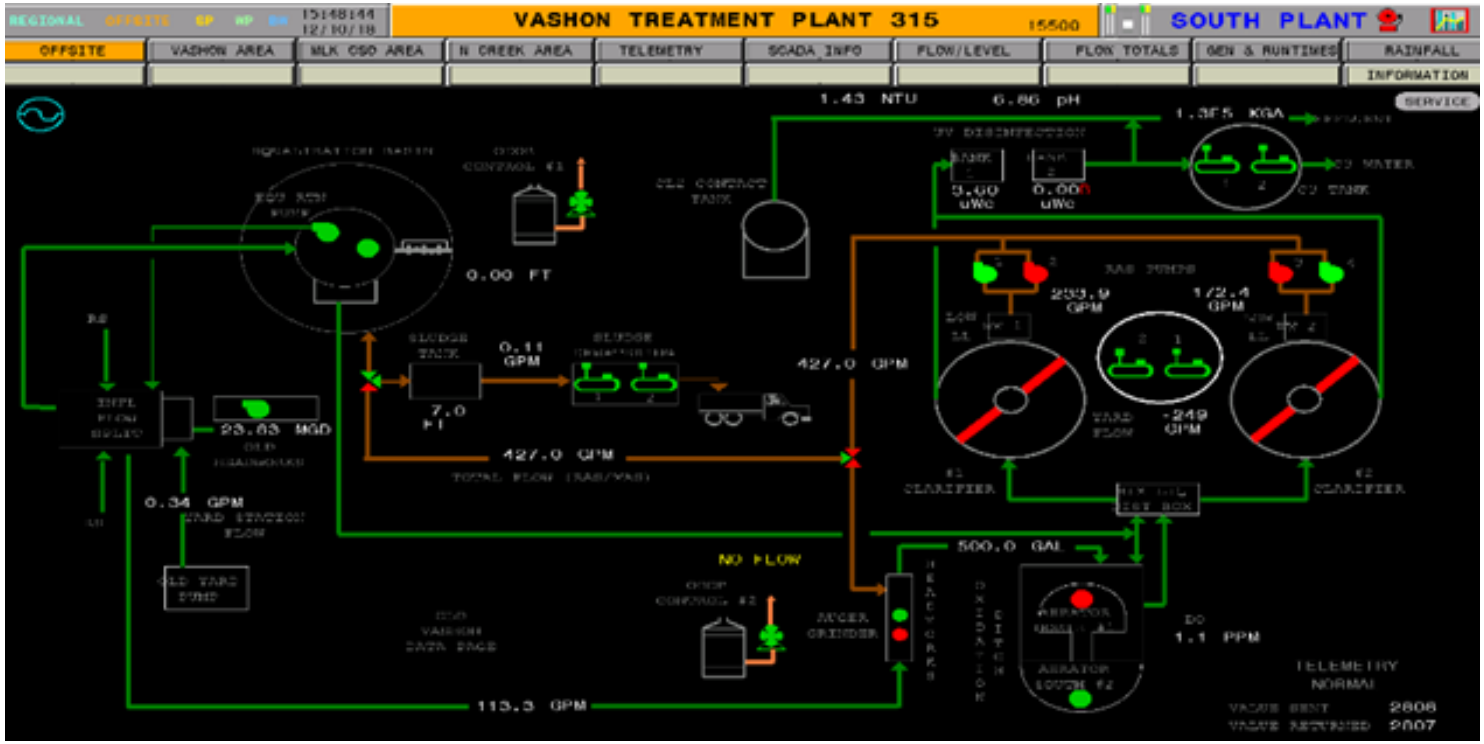
Vashon



Vashon Process Diagram

Process Description

Vashon

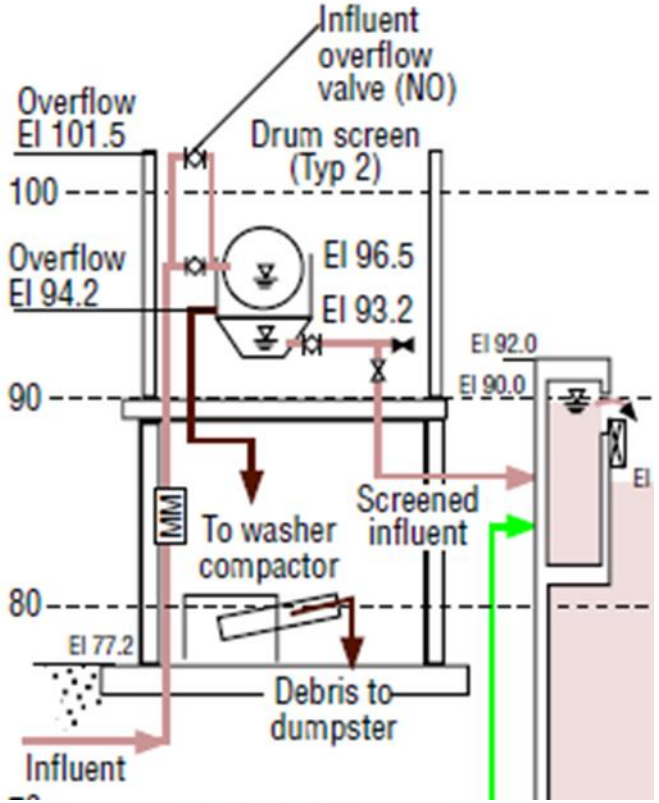


Vashon Ovation Screen

Process Description

Carnation – Grinder and 2mm Drum Screens

Influent from city vacuum pump station (waste is pulverized)



Carnation Process Diagram

Process Description

Carnation

Drum Screen

Process Description

Carnation

Internal view

Process Description

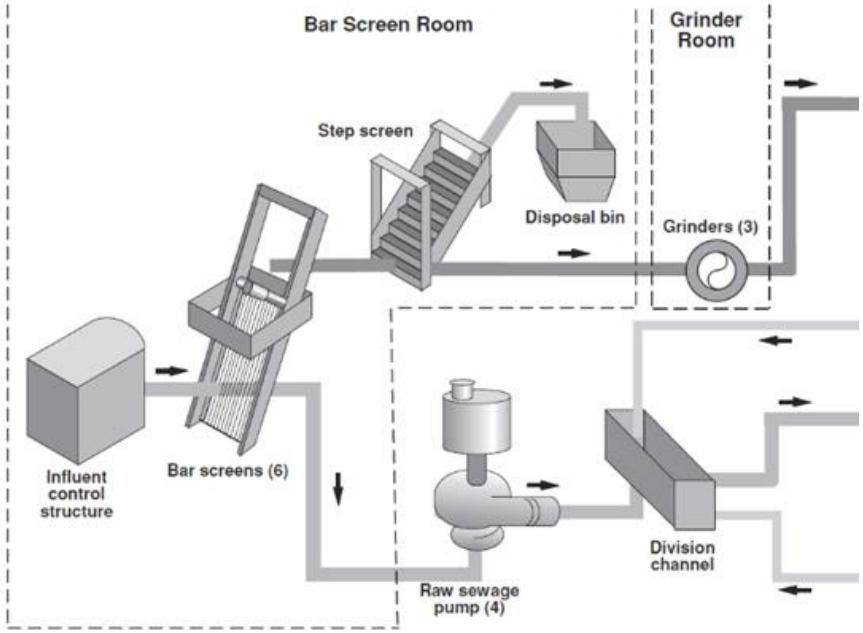
Carnation

Screenings grinder compactor

Process Description

South Plant – Mechanically Cleaned Bar Screens

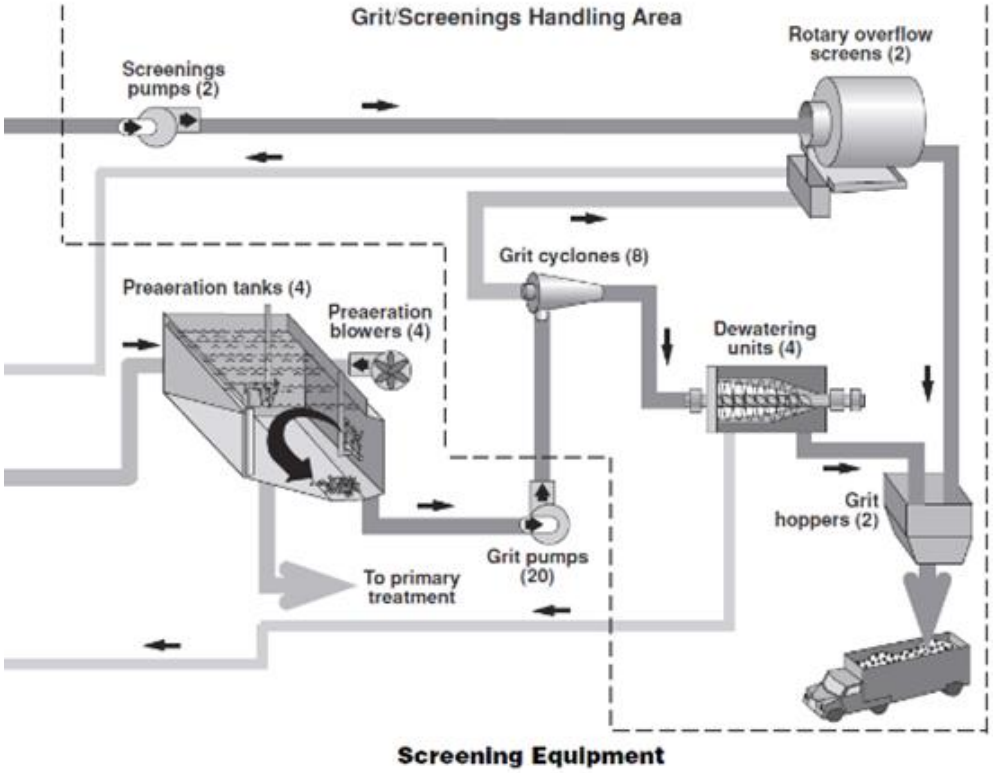
Bar openings: 2 @ 0.75, 4 @0.375, 2 @ 0.44



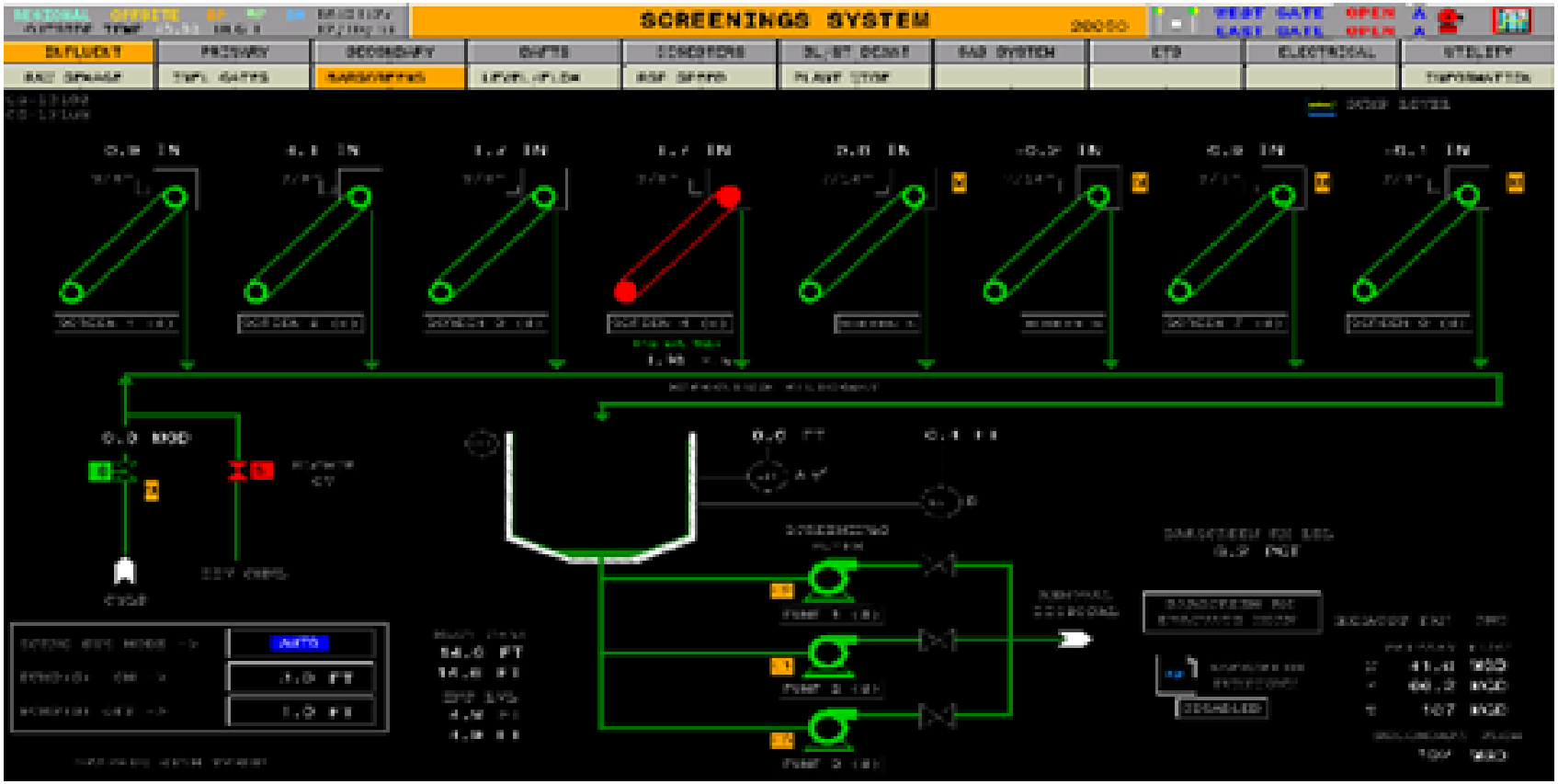
Bar Screen Room

Process Description

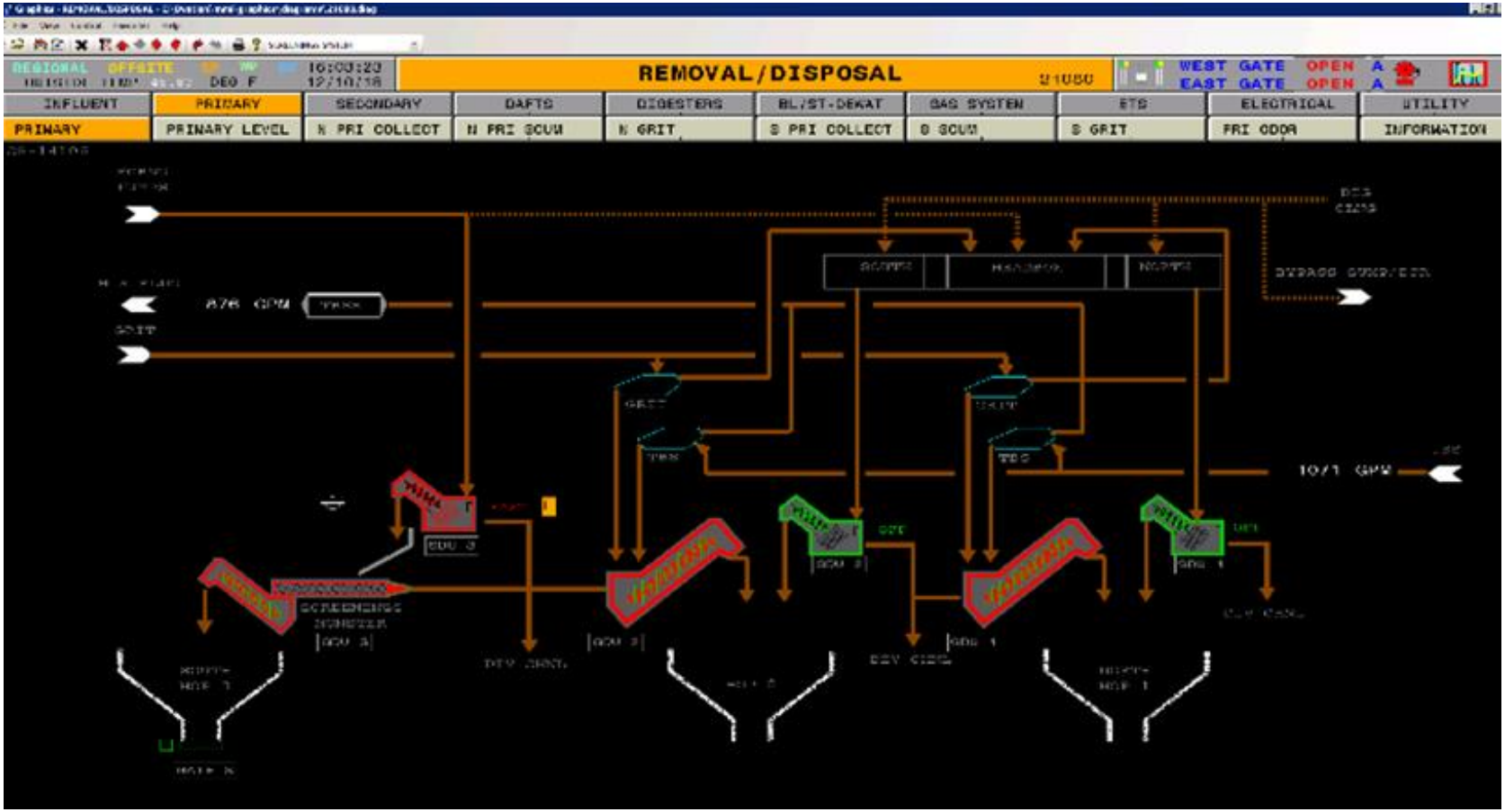
South Plant



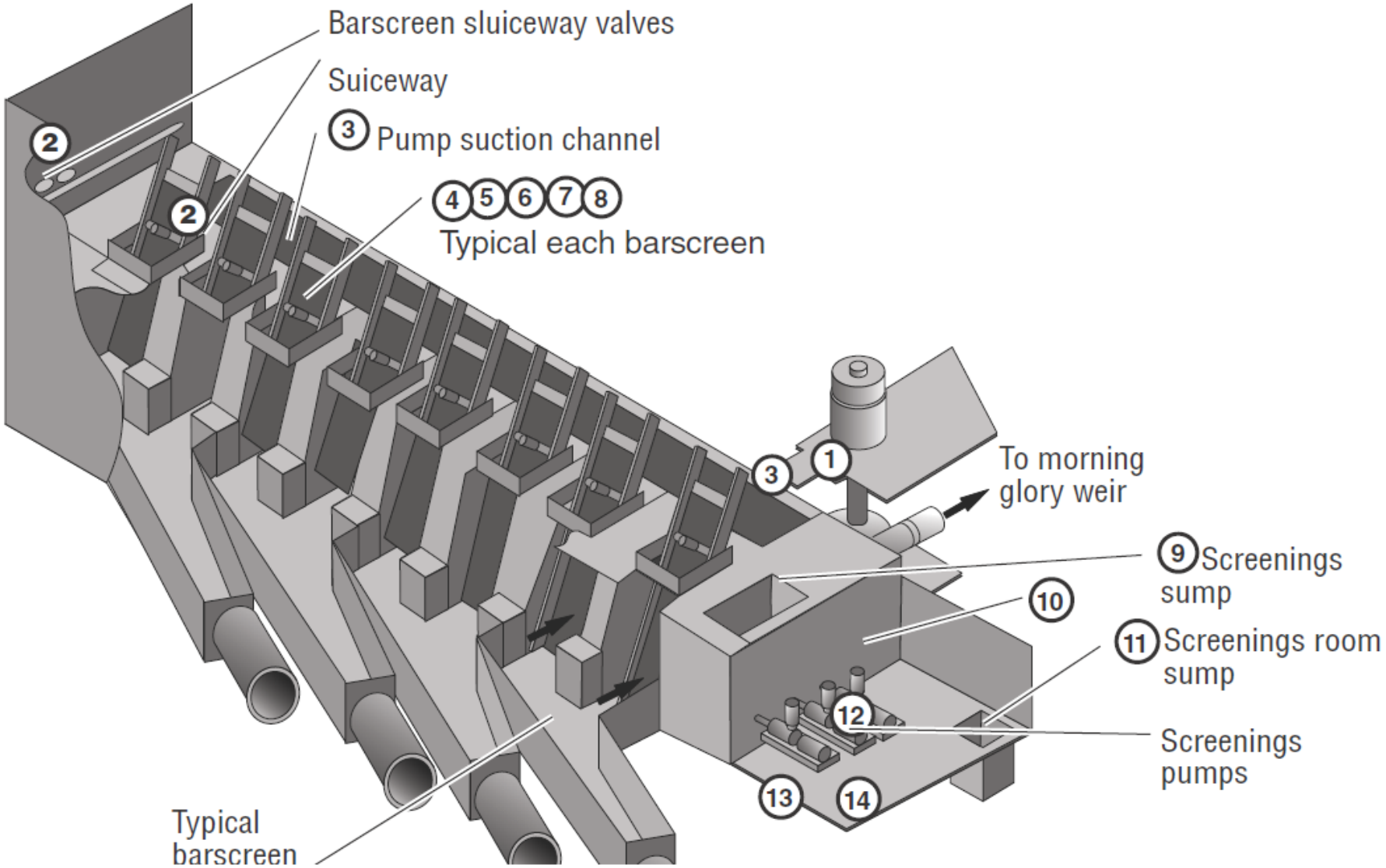
Grit Handling



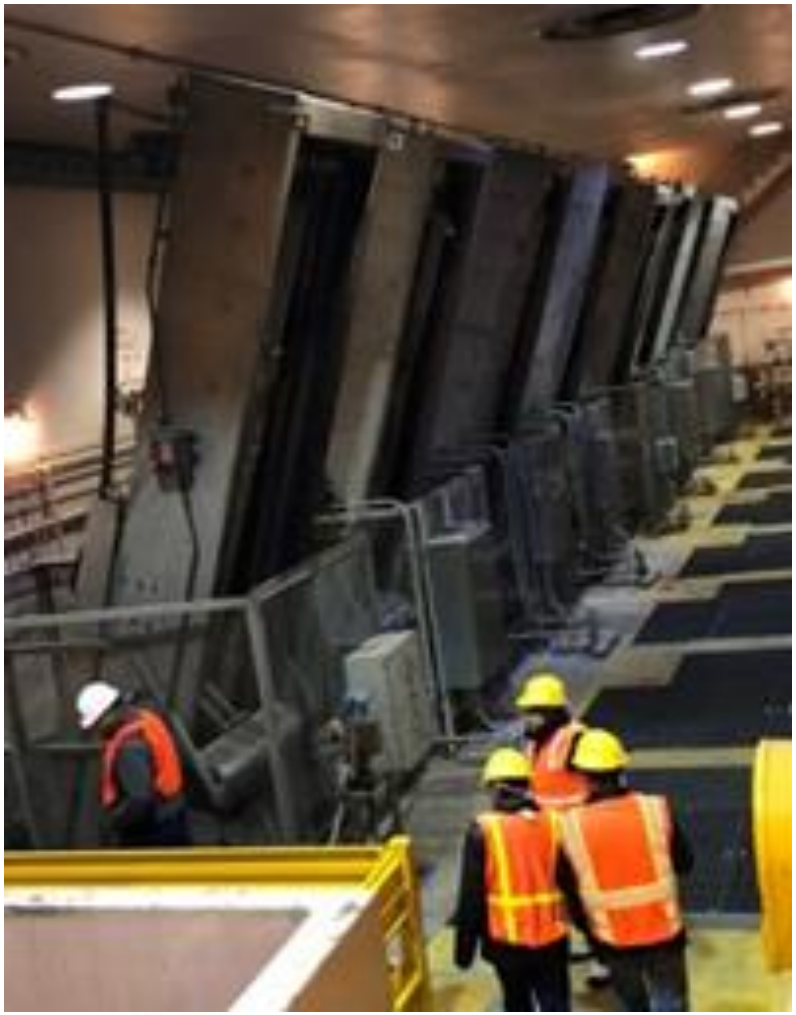
Ovation Screen Control – Manual, Level and DP

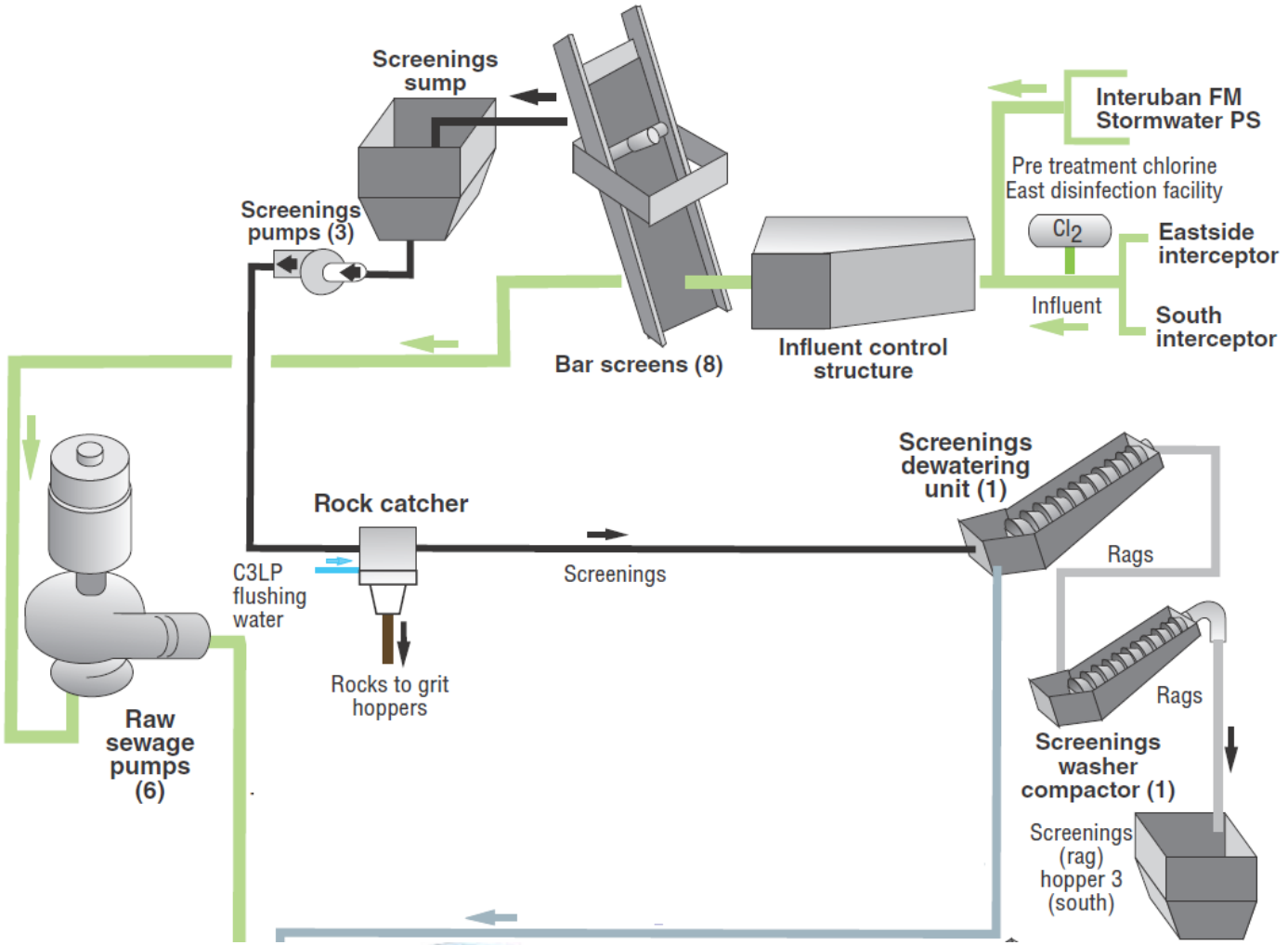


Ovation Grinders and Compactors


Barscreen sluiceway valves
Suiceway
3 Pump suction channel
4 5 6 7 8
Typical each barscreen
2
2
3
1
To morning glory weir
9 Screenings sump
10
11 Screenings room sump
12
Screenings pumps
13
14
Typical barscreen

Screen Room




Screenings sump
Screenings pumps (3)
Bar screens (8)
Influent control structure
Interuban FM Stormwater PS
Pre treatment chlorine East disinfection facility
Cl_2
Eastside interceptor
Influent
South interceptor
Rock catcher
C3LP flushing water
Rocks to grit hoppers
Screenings
Screenings dewatering unit (1)
Rags
Rags
Screenings washer compactor (1)
Screenings (rag) hopper 3 (south)
Raw sewage pumps (6)

Checking the Bar Screen and Screenings Levels of the Pump Building

1. Check for atmosphere alarms; if there are atmosphere or engulfment alarms leave the building and notify the DCB.

2. Check the screenings sluiceway.
The sluiceway water control valve should open automatically when the sump level is at setpoint, and close automatically when the sump level falls below setpoint. The setpoints for the valve and pump are adjusted on Ovation.

3. Check the pump suction channel.

a) Visually check the pump suction channel level. The level should correspond to the digital readout on the west wall near bar screen 7 and the set point indicated on Ovation. You will be able to approximate the channel level through experience.

DANGER

If you remove suction channel grating you MUST wear fall protection equipment.

b) Use a hook to remove the debris sticks and other large floating items.

c) Purge the three bubblers one at a time: turn the top valve to OFF, then pull the bubbler PURGE button all the way out, push to the detent, wait 15 seconds, and then push all the way in. When finished leave one top valve in ON to measure the channel and control the RSPs. Check that the rotameters read between 0.8 and 1.0.

4. Check the magnehelic reading on the bar screen flow panel.
A normal reading is 3 to 5 psig.

5. Check the upstream and downstream rotameters.
A normal reading is between 0.8 and 1.0 cfm.

6. Purge the barscreen channel bubblers.
Bubblers vary, some are plunger/detent type some have NORMAL/PURGE switches (some also call the switch BLEED inside the cabinets. Some barscreens operate off pressure switches and not bubblers.

7. Check the bar screens.

a) Make sure that the bar screen rakes are operating normally.

b) Check the motor for excessive noise.

c) Check the brakes.

• Check for excessive heat.

• Check for dragging (you will hear a hissing sound if the brakes are dragging).

d) Check the carriage — there should not be excessive bumping or jolting.

e) Check the gearbox.

• Check for excessive heat.

• Check for oil leaks. (Check for oil stains below the flanges where the motor is bolted on.)

f) Stand on the upstream side of the barscreen
to check for proper alignment. There should be about 3/4-inch clearance between
the rake arm and the frame on each side. The rake should move straight over the bars
— it should not jump over to the side.
g) Check that the sprockets on the ends of the
motor carriage shaft are tight and moving the carriage smoothly on the track

h) Check that the guide rollers are tracking straight.
i) Check the red overtorque springs on the bar
screen carriages.
The springs should compress and trigger an
alarm when the rake is stuck. Under normal operating conditions, the springs should not be compressed too tightly.

8. Check the bar screen local control panels
for alarms.

The local control panels differ slightly from each other. All panels have TORQUE OVERLOAD
and MOTOR AND BRAKE HI TEMPERATURE
alarms. Some also have HIGH DIFF
and HIGH CHANNEL alarms.

9. Remove sticks and other large floating
items from the screenings sump.

Checking the screenings level

1. Check the screenings sump level indicator.

The indicator should rise as the screenings sump fills with flushing water and fall as the sump drains. The pump runs fill-and-draw. The setpoints are usually 5 feet and 1 foot ; they
can be adjusted on Ovation. The pump cycle
should match whichever setpoints are being
used.

2. Check the screenings room sump.

a) The sump pumps should be in AUTO. A level of about 3 feet is normal.

b) Purge the screenings room sump bubbler.

So the rotameter ball does not get stuck at the top when you purge; turn the rotameter to 0 (zero), Purge the bubbler normally (Pull the PURGE button all the way out; push in to the detent; wait 15 seconds; and then push the button all the way in). Then, turn the rotameter back to 0.8 – 1.0.

3. Check the screenings pumps.
Check for bearing noise, worn belts, and excessive
vibration. Check that the pump HOA switches are in AUTO.

4. Check the C2 sealwater manifold.
Verify that all manual valves are open. Solenoid
valves automatically provide seal water when the pump starts.

West Point - Process Description

6 screening units – 3/8 and 1/2

Normal operation is manual with minimum of two screens in operation

Differential Pressure (DP) across screen controls screen speed

Incline belts are at 45 degrees (ideal is 30)

New screens contribute to faster digester cleaning and higher quality biosolids

Ovation control screen

Isolation Gates upstream of screen units

Multiple screen unit conveyors feed incline conveyor

Conveyor belt conveys screenings to grinders

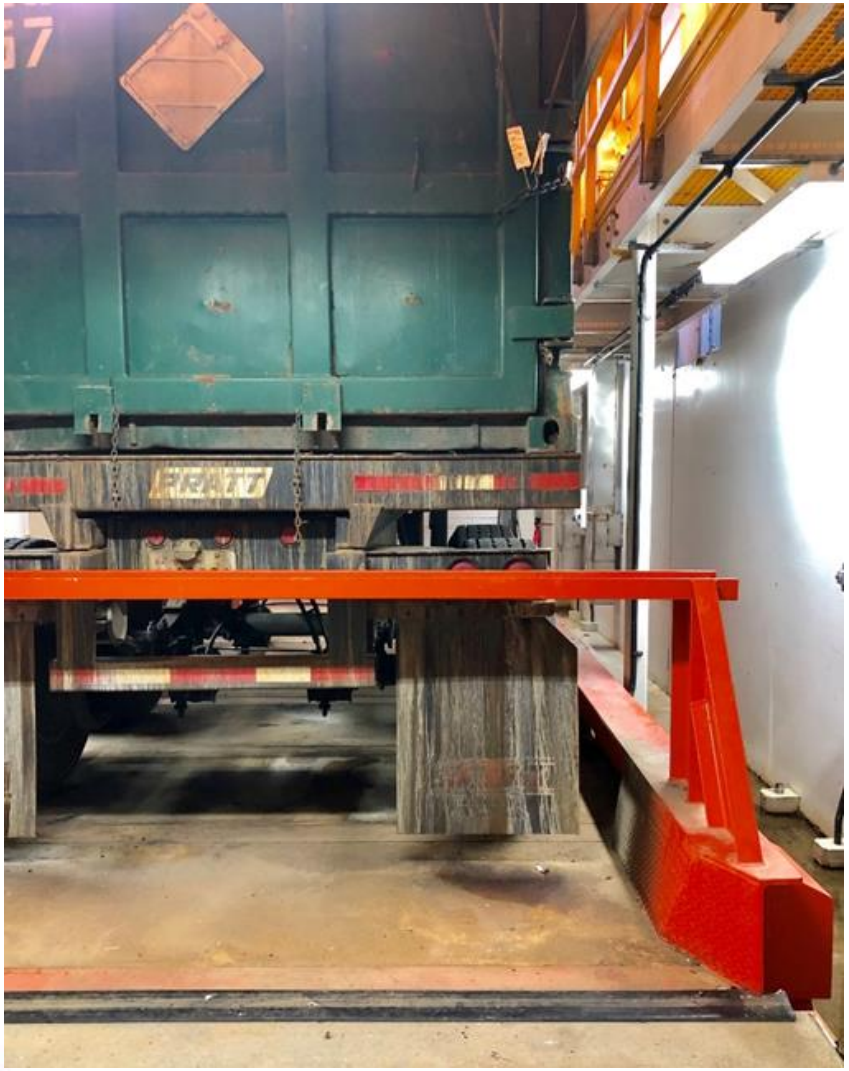
Grinders – always on-line

Washer Compactor operation - water to 67” screenings to 87” switch to follow compactor – full compactor agitates then drains – follow compactor fills with water to 67”

Clean compacted screenings load into roll away bin

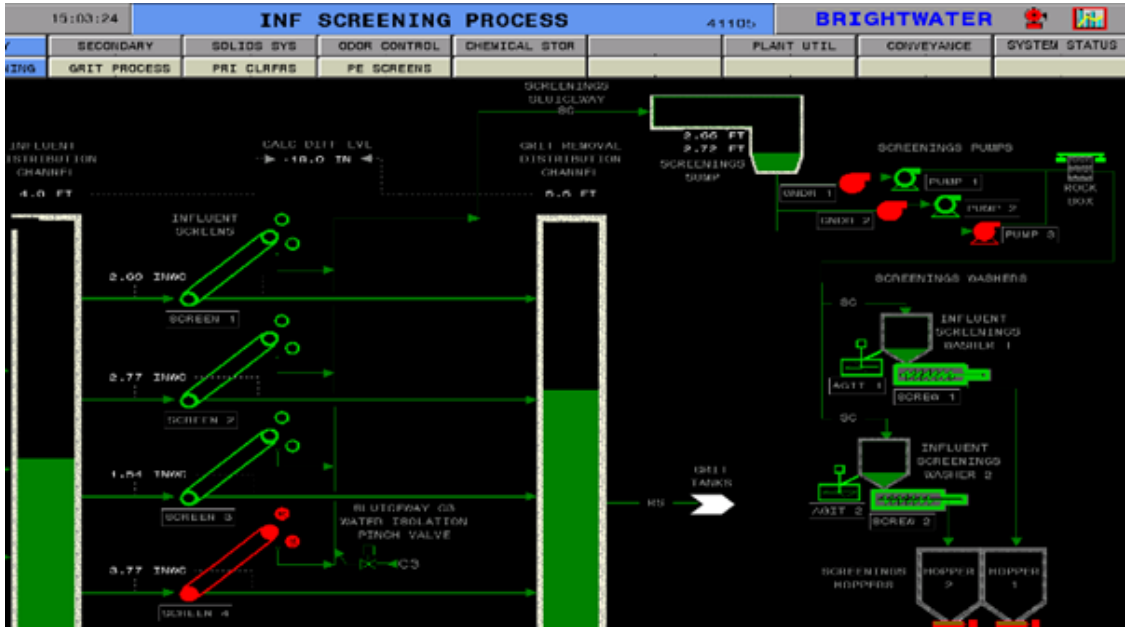
Surprisingly dry

Screenings weigh scale



Brightwater Primary and Secondary

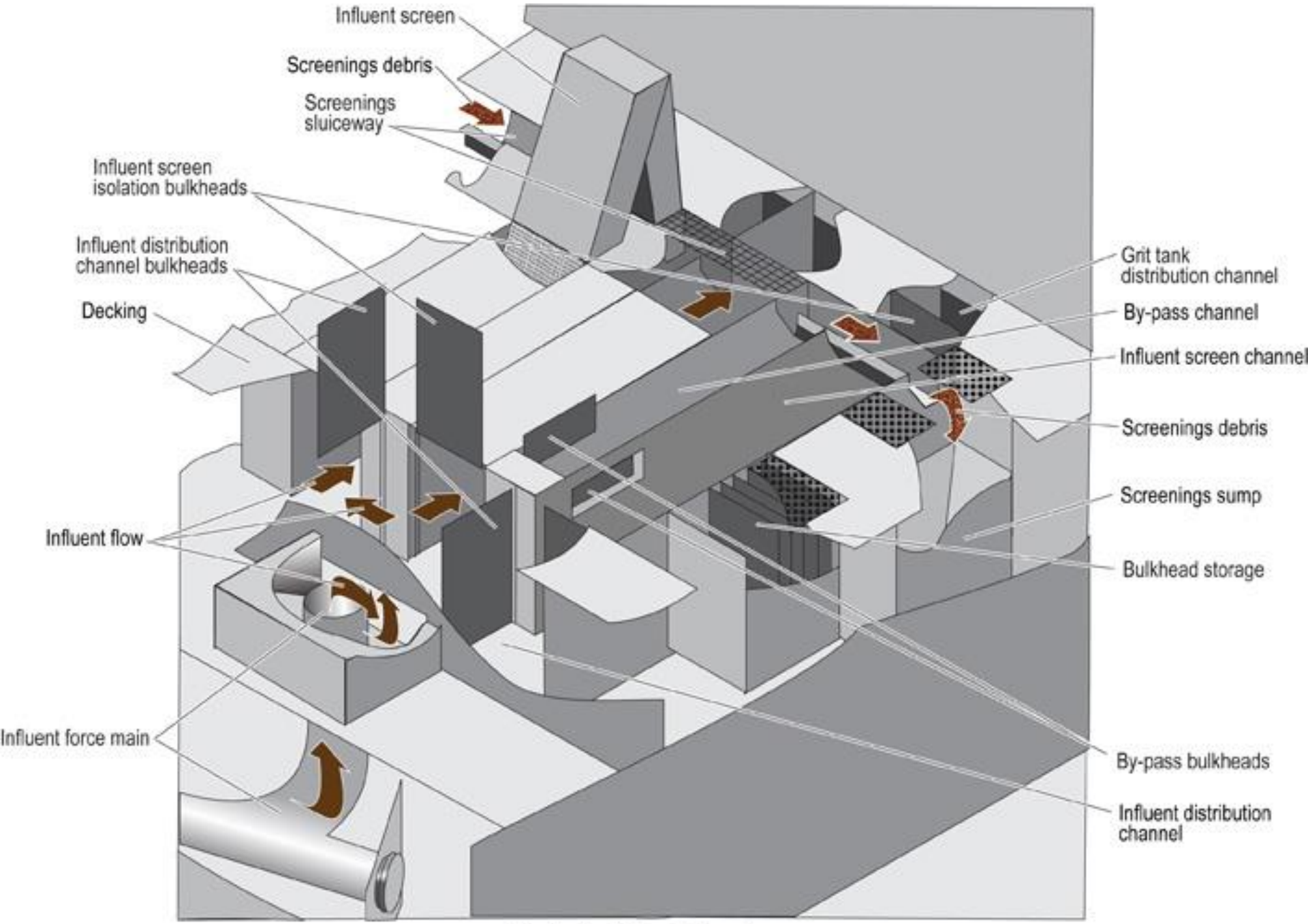
Headworks Screens: 10 mm perforated plate
PE Screens: 2 mm Band screens



Influent screens

Preliminary Influent Screens (4)	
BW-SN 300, 111, 112, 113, 114	
Specification Section	11256
Type	Perforated Plate
Capacity, each	43.34 mgd
Screen Opening	10 mm
Screen Angle	60 degrees
Screen Material	3 mm Stainless Steel or 9 mm Polyurethane
Screen Operating Speed	15 ft/30 min
Motor – HP/Voltage/Phase/Hz	1.5-3/480/3/60
Motor Type	Dual Speed

Influent screenings



Headworks influent channels

Influent screens

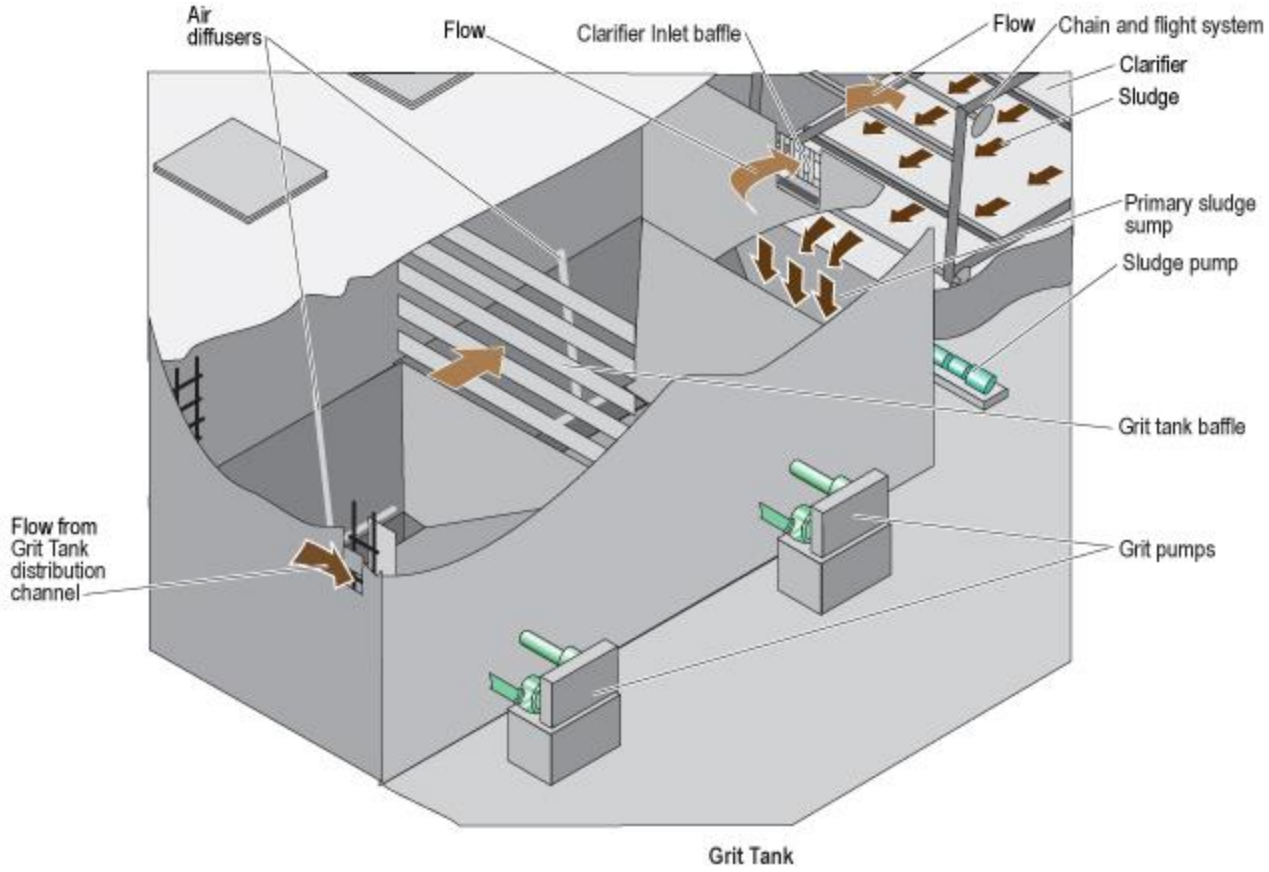
Debris captured by the screen panels

Influent screenings grinders

Influent screenings sump grinders and pumps

Screenings washer

Grit removal tanks


Air diffusers
Flow
Clarifier Inlet baffle
Flow
Chain and flight system
Clarifier
Sludge
Primary sludge sump
Sludge pump
Grit tank baffle
Flow from Grit Tank distribution channel
Grit pumps
Grit Tank

Grit Removal Distribution Channel Blowers (2)	
BW-B 300, 051, 052	
Specification Section	11486
Type	Multistage Centrifugal
Capacity, min	3600 scfm @ 3.9 psi
Size	12 in x 12 in
Motor - HP/Voltage/Phase/Hz	100/480/3/60
Motor Type	Constant Speed

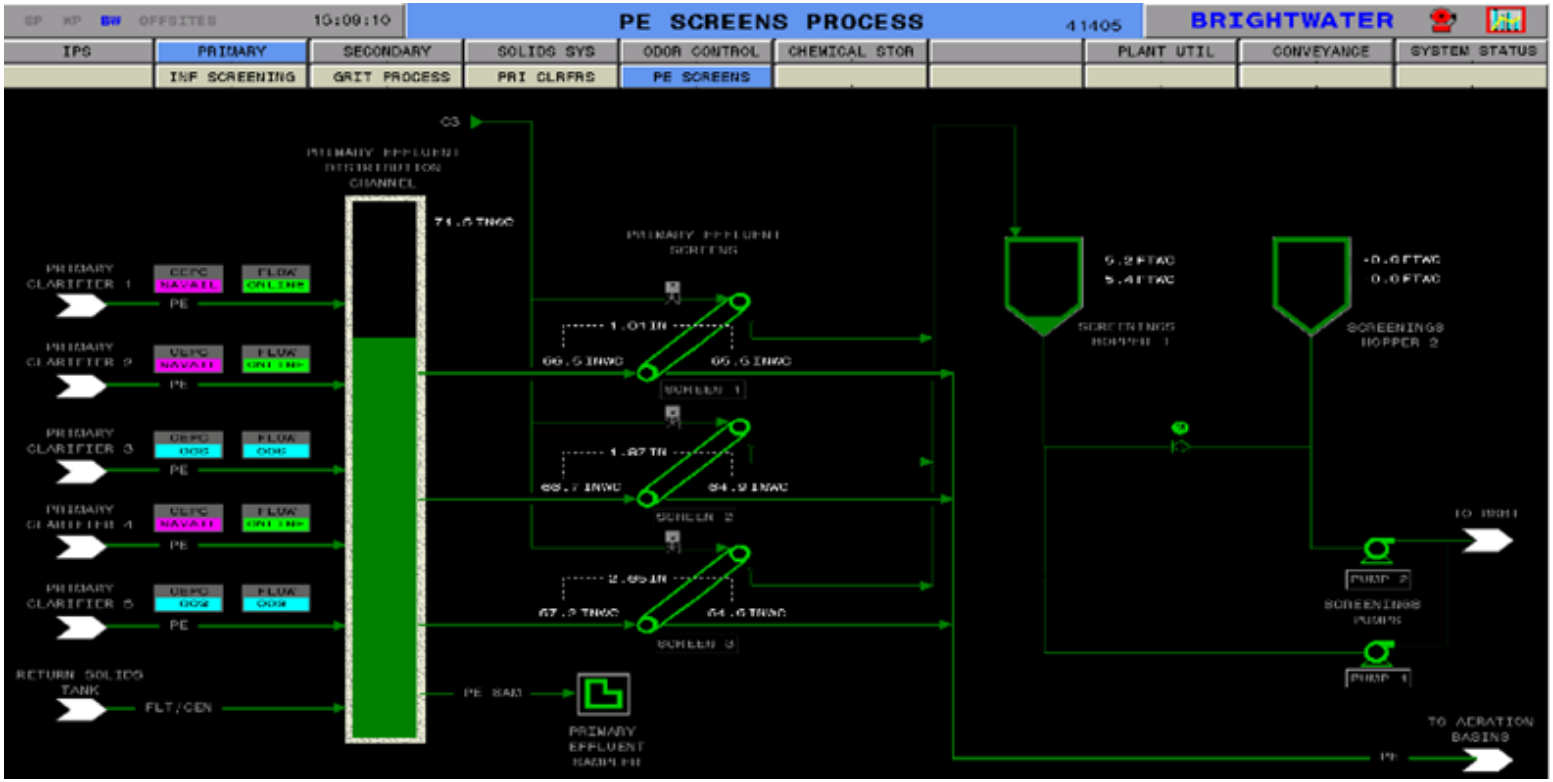
Grit Tank Blowers (2)	
BW-B 300, 016, 018	
Specification Section	11486
Type	Multistage Centrifugal
Capacity, min	1280 scfm @ 6.7 psi
Size	6 in x 6 in
Motor - HP/Voltage/Phase/Hz	100/480/3/60
Motor Type	Constant Speed

Grit distribution channel and grit tank blowers

Grit tank pumps

Grit cyclones

Grit washers



Primary effluent screens

Primary Effluent Screening

Design Parameter	Values/Unit
Primary Effluent Screen Influent Channels (3)	
Dimensions, per channel	5.75 ft W x 8 ft SWD
Influent Channel Velocity, peak hour	1.3 fps
Primary Effluent Screens (3)	
BW-SN 420, 111, 112, 113	
Specification Section	11257
Type	Center Feed Band
Capacity, each	23.75 mgd @ 6.8 ft immersion
Screen Openings	**2 mm**
Channel Inlet, width	5.75 ft
Channel Outlet, width	12 ft
Channel, depth	10.77 ft
Channel Upstream, max water depth	8 ft
Screen Headloss @ 50% Blind, max	4 in
Operating Speed, max	32 fpm
Motor - HP/Voltage/Phase/Hz	3-7.5/480/3/60
Motor Type	Dual Speed

Primary effluent Screens

Effluent screen inlet channel slide gate

Primary effluent screen

Control panel

Primary effluent screenings hopper pumps

"Mr. Osborne, may I be excused? My brain is full."