PRELIMINARY TREATMENT (aka PRETREATMENT)

WE WILL DISCUSS THE HEADWORKS:

- **WET WELL (PUMPS)**
- **SCREENS**
- **GRIT REMOVAL**
- **SHREDDERS**

MOST TREATMENT PLANTS ARE BUILT DOWN-GRADIENT FROM THE AREA SERVED

WWTP

SAVES $ TO MAKE USE OF "NATURAL" FORCES—GRAVITY, SUNLIGHT, WIND BIOLOGICAL ACTIVITY

SOMETIMES, PLANTS HAVE TO BE LOCATED "UP-GRADIENT…

- **LAND AVAILABILITY**
- **HIGH GROUND WATER TABLE**

MIGHT REQUIRE LOW-LIFT PUMPS

PUMPS

REQUIREMENTS FOR A GOOD PUMP ARE:

- HANDLES VARIABLE FLOW
- MUST HANDLE DEBRIS
- FEWER MOVING PARTS—THE BETTER

SCREW PUMPS

ARCHIMEDES INVENTED THE SCREW PUMP

ALSO KNOWN AS THE "ARCHIMEDES SCREW"

ARCHIMEDES MORE FAMOUS FOR HIS "LAW OF BUOYANCY"

ALSO INVENTED/DEVELOPED:

- **CATAPULTS**
- **BURNING MIRRORS**
- **LEVER THEORY**

SCREW PUMPS

USED FOR:

- **RAW AND TREATED SEWAGE LIFT STATIONS**
- **ACTIVATED SLUDGE RETURN**
- **STORM WATER PUMPING**
- **LAND DRAINAGE/INDUSTRIAL WASTE**

SCREW PUMPS

- AVAILABLE FROM 1-FOOT TO 12 FEET DIAMETER

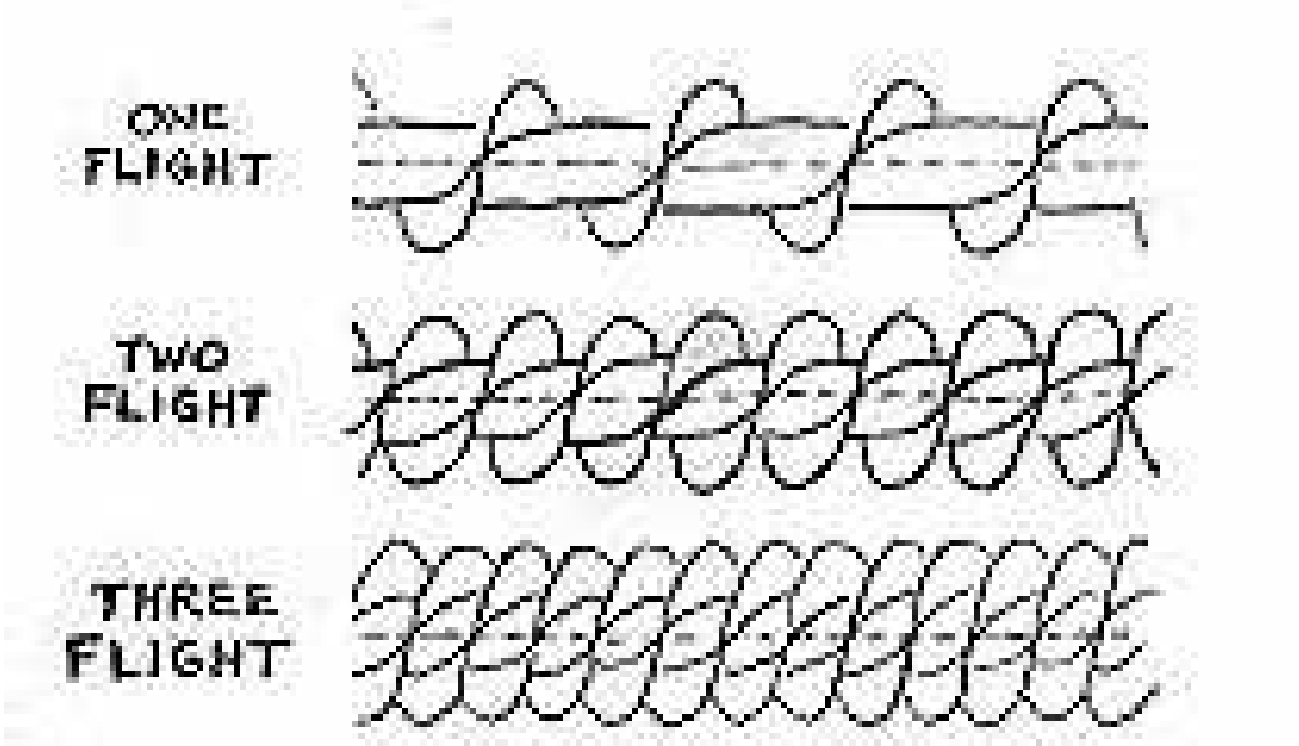
- HANDLES FLOWS FROM:

  100 to 95,000 GAL/MIN

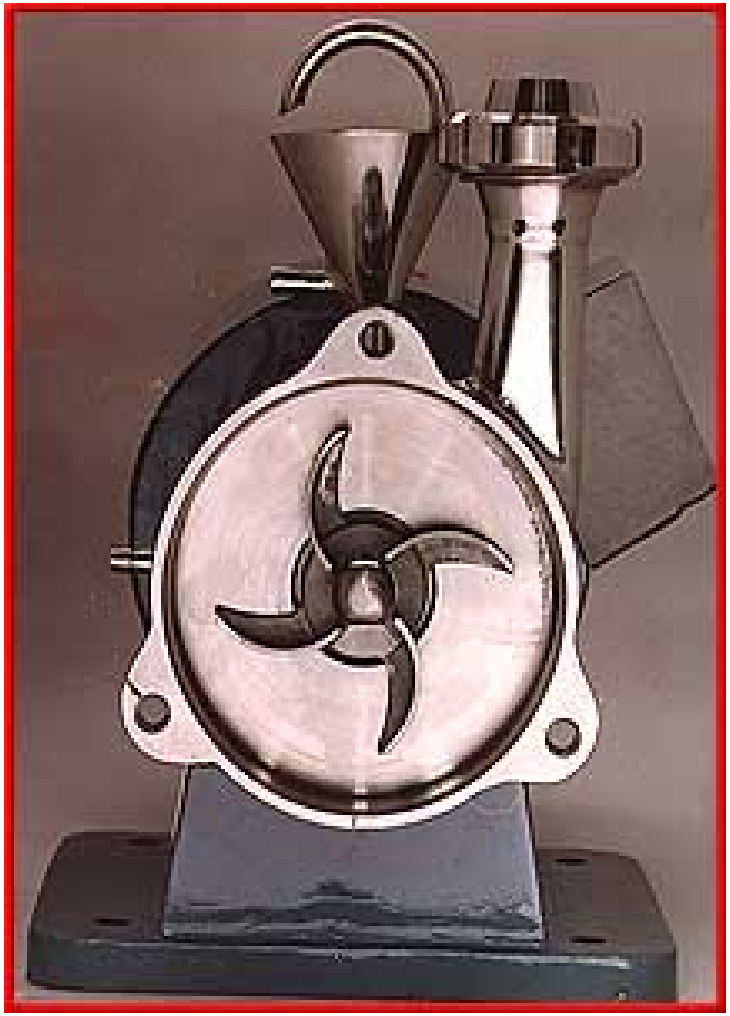
- LIFTS FROM 6 to 40 FEET

CLOSED SCREW PUMP

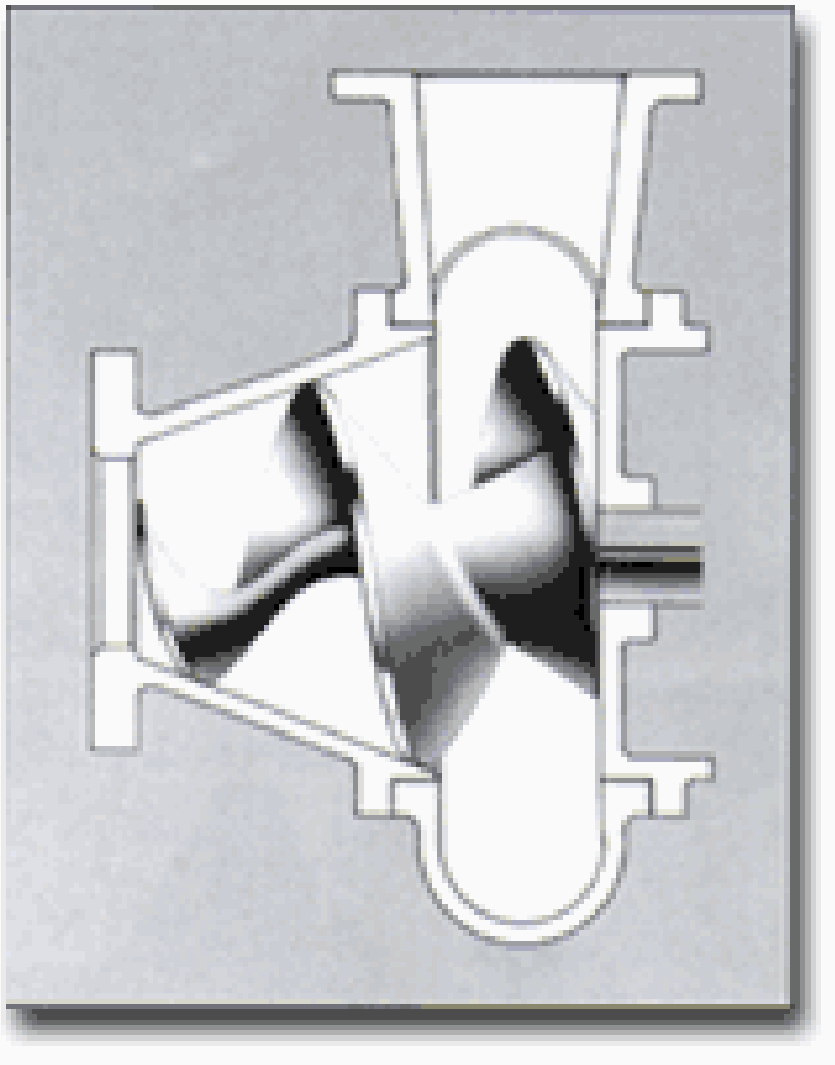
OPEN SCREW PUMP



FLIGHTS (or HELIXES) ON A SCREW PUMP



CENTRIFUGAL PUMP



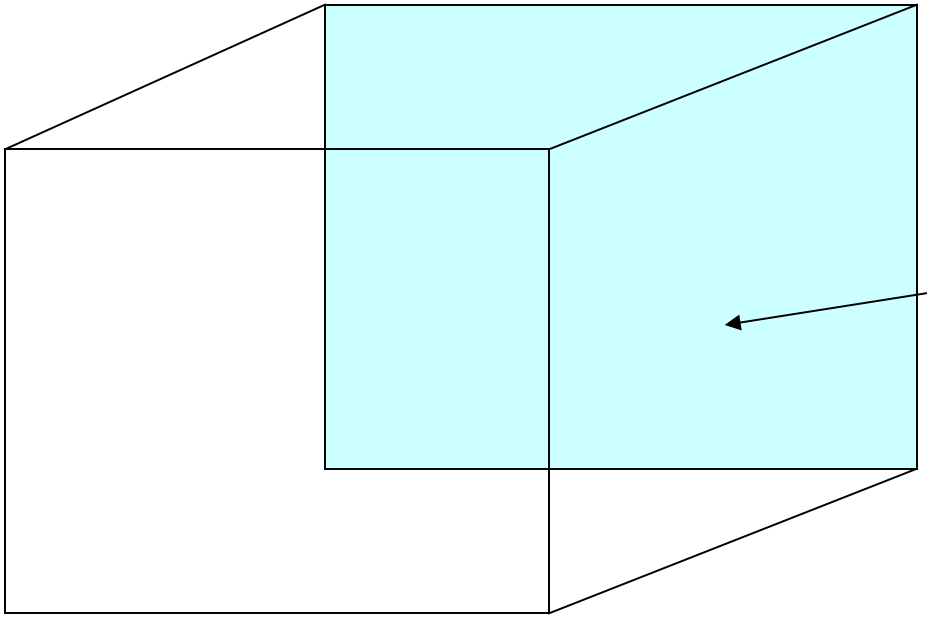
CENTRIFUGAL SCREW PUMP

"HEAD" and "HEAD LOSS"

"HEAD" REFERS TO FLUID PRESSURE or ENERGY

"HEAD LOSS" REFERS TO ENERGY or FRICTION LOSS

BOTH ARE EXPRESSED IN INCHES or FEET of WATER



One cubic foot of water

WEIGHS 62.4 POUNDS

ONE FOOT OF "HEAD" IS EQUIVALENT TO 0.433 pounds/sq in

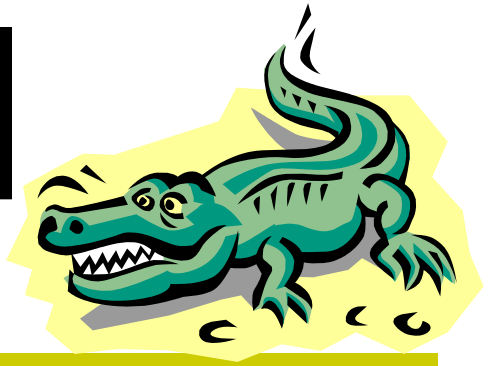
PRELIMINARY TREATMENT

(aka PRETREATMENT)

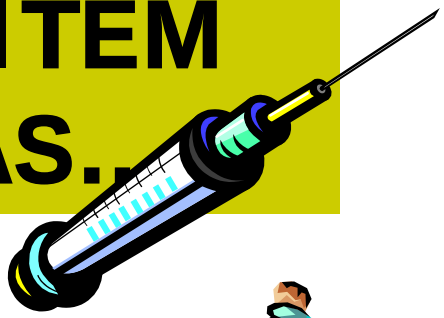
- SCREENING: TO REMOVE LARGE DEBRIS

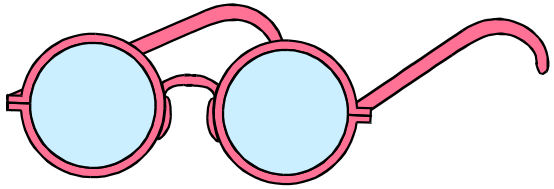
- **RACKS and BAR SCREENS**

SCREENING



PURPOSE: TO REMOVE LARGE, NON-BIODEGRADABLE ITEM FROM SEWAGE SUCH AS..





RACKS

- BAR SPACING 3 to 4 INCHES

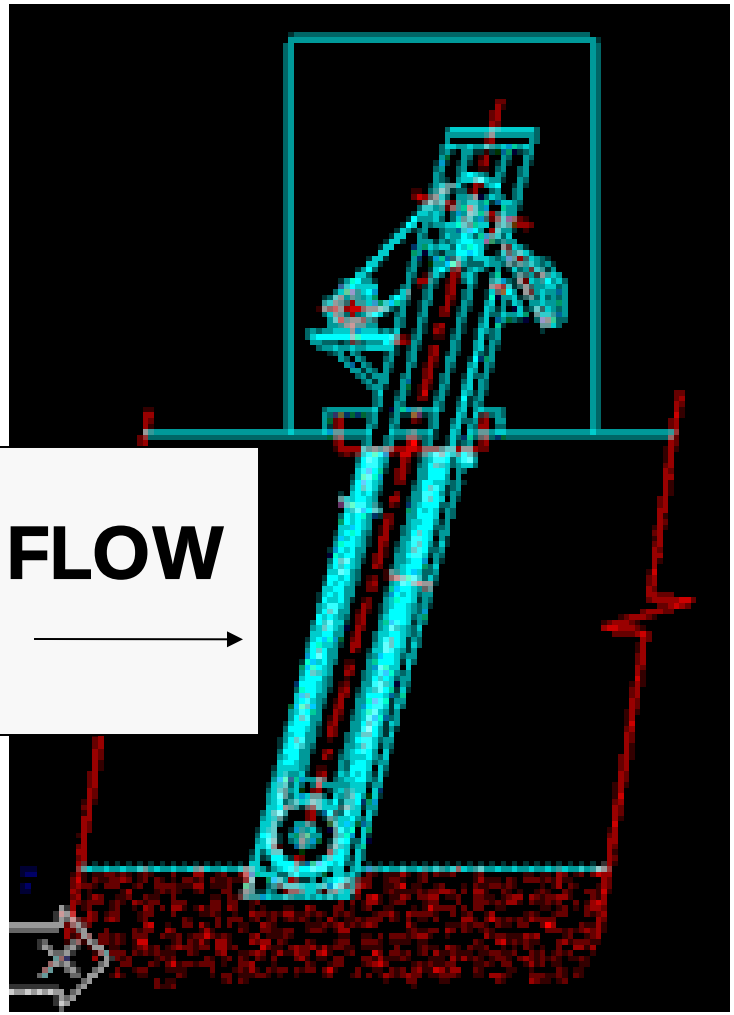
- INCLINED UP TO 45 DEGREES

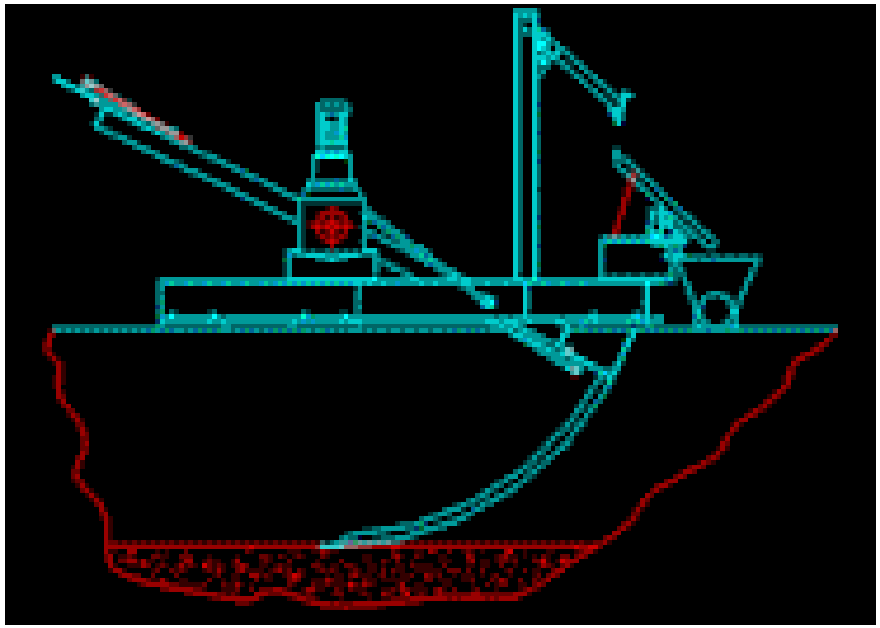
- USUALLY MANUALLY CLEANED

BAR SCREENS

- BAR SPACING 3/8 to 2 INCHES

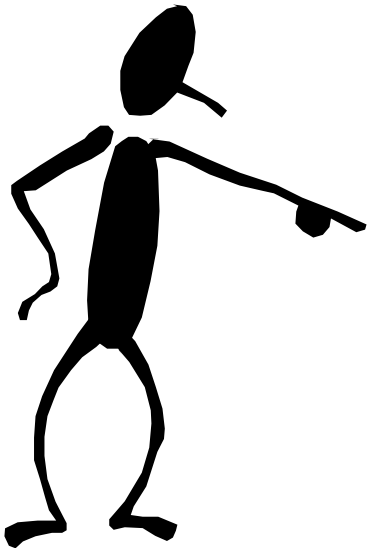
- OFTEN MECHANICALLY CLEANED



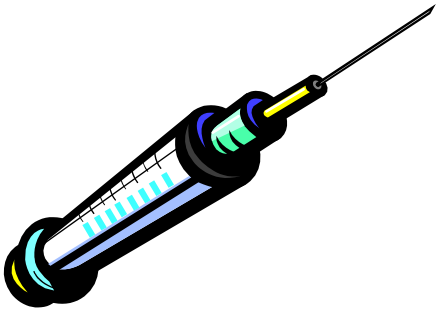


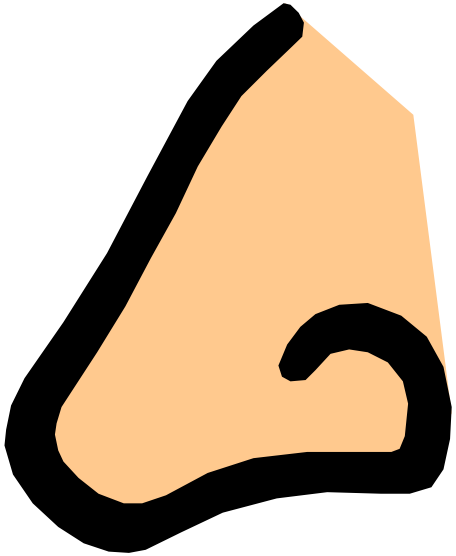
INCLINED & RADIAL BAR SCREENS

TURN OFF AND LOCK-OUT ANY ELECTRICAL EQUIPMENT BEFORE YOU WORK ON THEM !



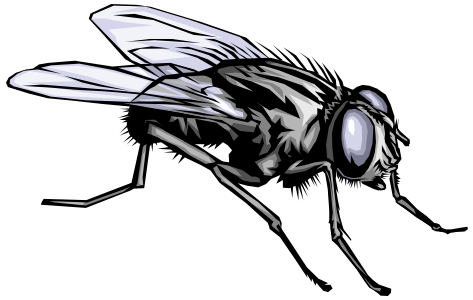
KEEP THE SCREENS CLEAN TO REDUCE HEAD LOSS (AND COSTS)





SCREENINGS "STINK" AND MAY BE HAZARDOUS

DISPOSE OF BY BURIAL OR INCINERATION



- **BURY WITH AT LEAST 6 INCHES OF COVER- - TO DISCOURAGE VECTORS**

- **NO ADVERSE AFFECTS ON GROUND OR SURFACE WATERS**

GRIT REMOVAL

RECALL:

"GRIT" IS HEAVY INORGANIC MATERIAL SUCH AS SAND, EGG SHELLS, CINDERS

"GRIT", WHEN MIXED WITH GREASE, TAR AND OTHER CEMENTING MATERIALS...

- **WILL CAUSE EXCESSIVE WEAR ON PUMPS**

- **WILL CLOG PIPES and SUMPS**

GRIT + OIL + GREASE = *DETRITUS*

IN SOME AREAS, GRIT CHAMBERS (or CHANNELS) ARE CALLED "DETRITUS TANKS"

WASTEWATER CONTAINS SOME SOLIDS THAT WILL NEITHER SINK NOR FLOAT!

- COLLOIDS = FINELY DIVIDED DISPERSED SOLIDS
- EMULSIONS =LIQUIDS THAT WILL NOT DISSOLVE IN EACH OTHER (GREASE, FATS, OIL in WATER)

FLOATATION PROCESS

AIR IS PUMPED INTO THE WASTEWATER THEN REMOVED BY VACUUM OR RELEASED UNDER PRESSURE TO REMOVE COLLOIDS and EMULSIONS

TYPES OF GRIT CHAMBERS

1) HORIZONTAL FLOW

2) AERATED

3) VORTEX (cyclone separator)

HORIZONTAL GRIT CHAMBER

- **OLDEST TYPE AND MOST COMMON**

- **EXPERIENCE HAS SHOWN A VELOCITY AROUND 1 ft /sec IS BEST FOR GRIT REMOVAL**

MAINTAINING A CONSTANT FLOW THROUGH THE CHAMBER

BECAUSE INFLUENT QUANTITIES VARY, YOU MUST:

- **VARY THE NUMBER OF CHAMBERS ON LINE**

- **USE A PROPORTIONAL (aka SUTRO) WEIR AT THE OUTLET OF THE CHAMBER**

WHAT'S A PROPORTIONAL WEIR?

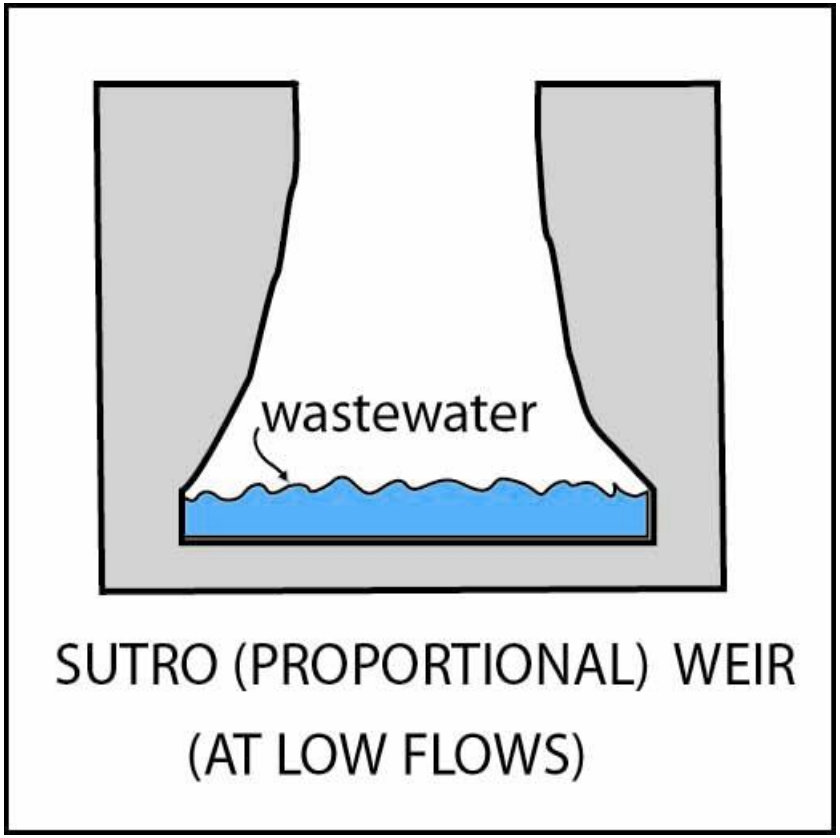
A SPECIALLY DESIGNED CONSTRICTION TO GO IN THE EFFLUENT END OF A GRIT CHAMBER

FLOW THROUGH THE WEIR IS PROPORTIONAL TO THE HEIGHT OF THE WATER IN THE CHANNEL

HOW A PROPORTIONAL WEIR WORKS:

$$Q = V \times A$$

WHERE: Q IS THE FLOW; V IS THE VELOCITY, AND A IS THE CROSS-SECTIONAL AREA



SUTRO (PROPORTIONAL) WEIR

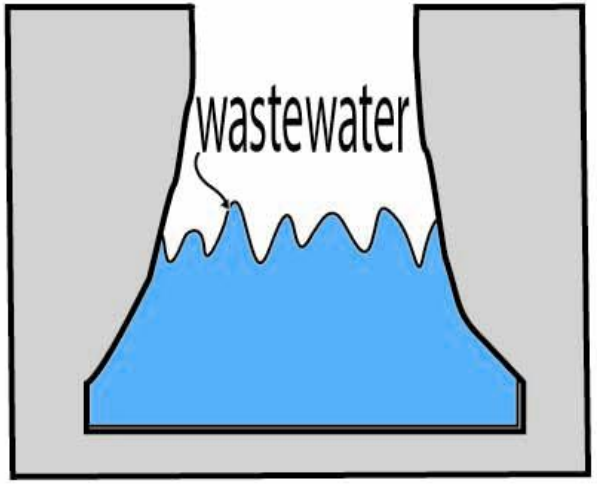
(AT LOW FLOWS)

VELOCITY = 1 FPS

HOW A PROPORTIONAL WEIR WORKS:

$V=Q/A$

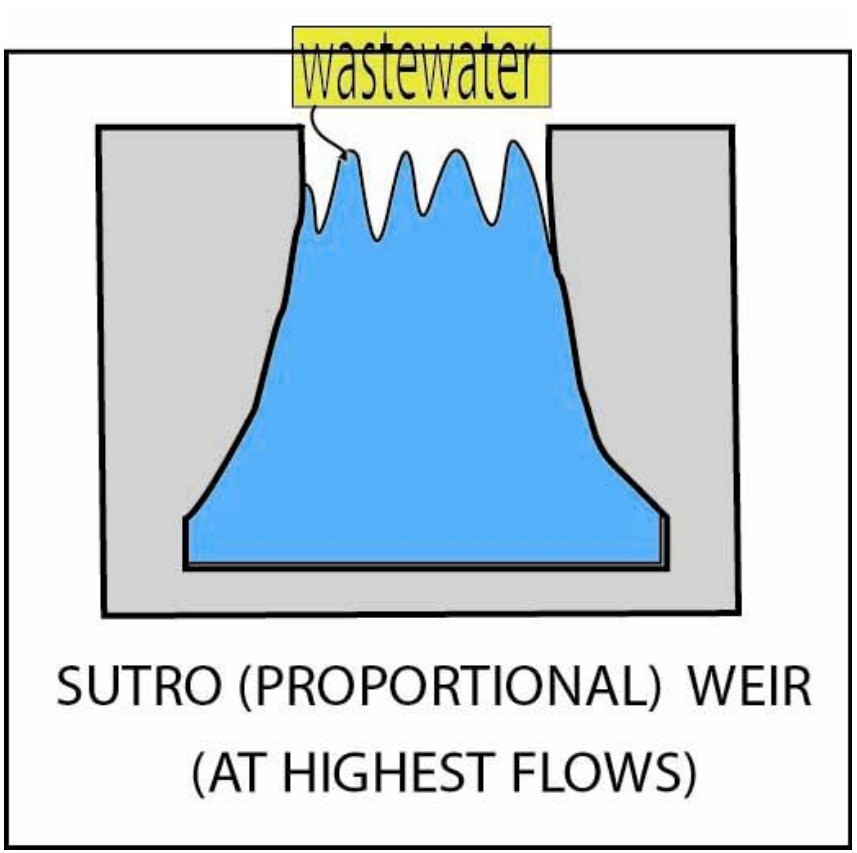
AS Q INCREASES, A MUST DECREASE FOR V TO REMAIN AT 1 FPS.



SUTRO (PROPORTIONAL) WEIR
(AT HIGHER FLOWS)

VELOCITY = 1 FPS

HOW A PROPORTIONAL WEIR WORKS:



VELOCITY remains = 1 FPS

HOW TO MEASURE VELOCITY IN A GRIT CHAMBER

ONE EASY WAY IS TO DROP IN SOMETHING THAT FLOATS AND TIME IT OVER A MEASURED DISTANCE

GRIT CHAMBER VELOCITY

EXAMPLE: YOU DROP IN A STICK AND IT TAKES 20 SECONDS TO FLOAT 25 FEET.

VELOCITY = 25 FT / 20 SEC = 1.25 fps

PARTICLE REMOVAL in a grit chamber

- **DESIGNED TO REMOVE 0.2 mm SAND PARTICLES**

- **0.2 mm SAND SETTLES AT 22 mm/sec (0.075 ft/sec)**

- **About 13 sec for a particle to settle 1 ft (1 ft/0.75 ft/sec = 13.3 sec)**

SHORT CIRCUITING AND "DEAD" SPOTS IN TANKS

NO TANK IS PERFECT WHEN IT COMES TO FLOW

DEAD SPOTS (LITTLE or NO FLOW) DEVELOP WHERE ORGANICS CAN SETTLE OUT

DEAD SPOTS CAUSE PROBLEMS

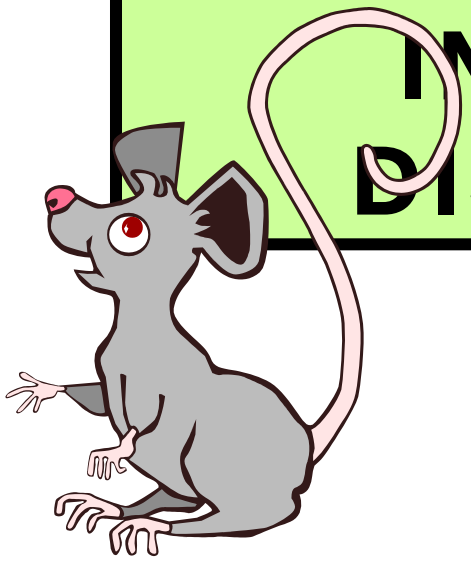
ORGANICS BEGIN SETTLING AND BECOME "PUTRESCIBLE"

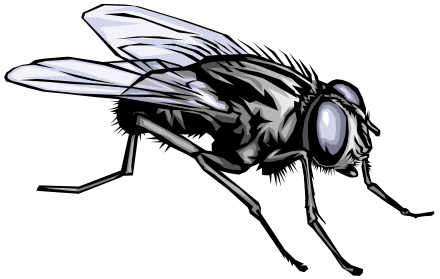
SOMETIMES DEFLECTORS CAN BE PLACED IN THE GRIT CHAMBER TO MINIMIZE DEAD SPOTS

GRIT DISPOSAL

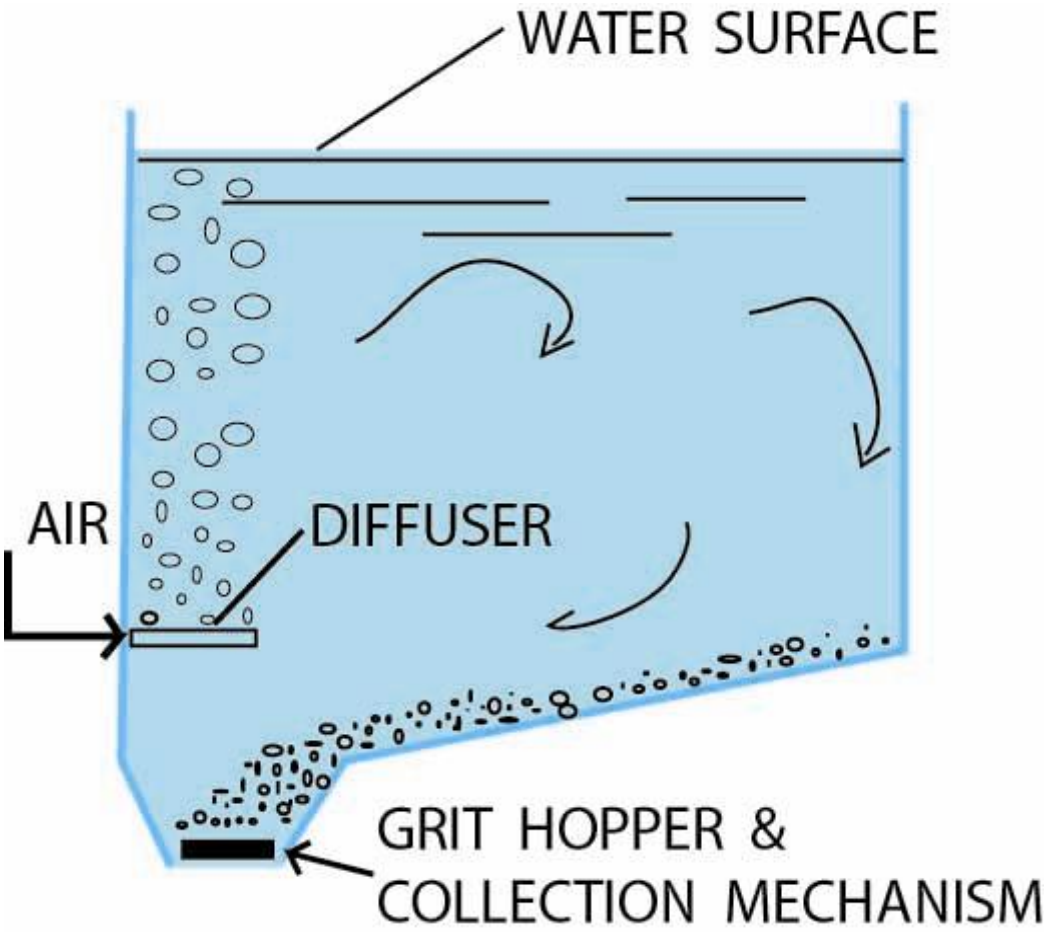
- SHOULD BE REMOVED DAILY

- BURIED WITH AT LEAST 6 INCHES OF COVER TO DISCOURAGE VECTORS





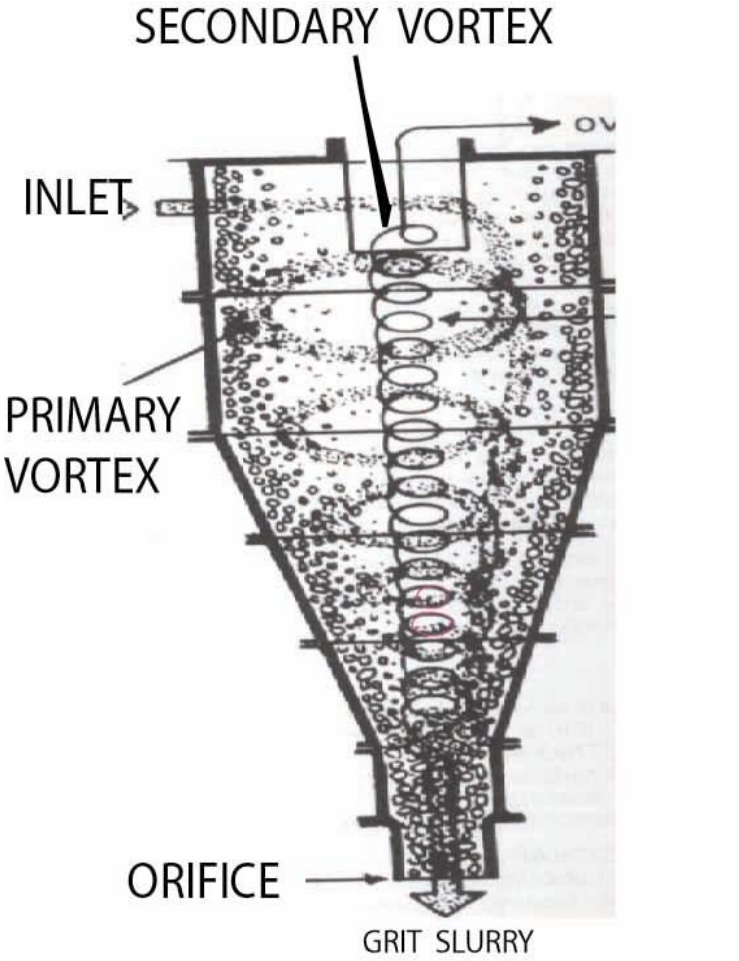
AERATED GRIT CHAMBER



AIR/WATER MIXTURE HAS LOWER SPECIFIC GRAVITY THAN WATER ALONE- GRIT SETTLES

VORTEX (CYCLONE) GRIT SEPARATOR

CENTRIFUGAL FORCE MOVES HEAVIER PARTICLES TO OUTSIDE WALL

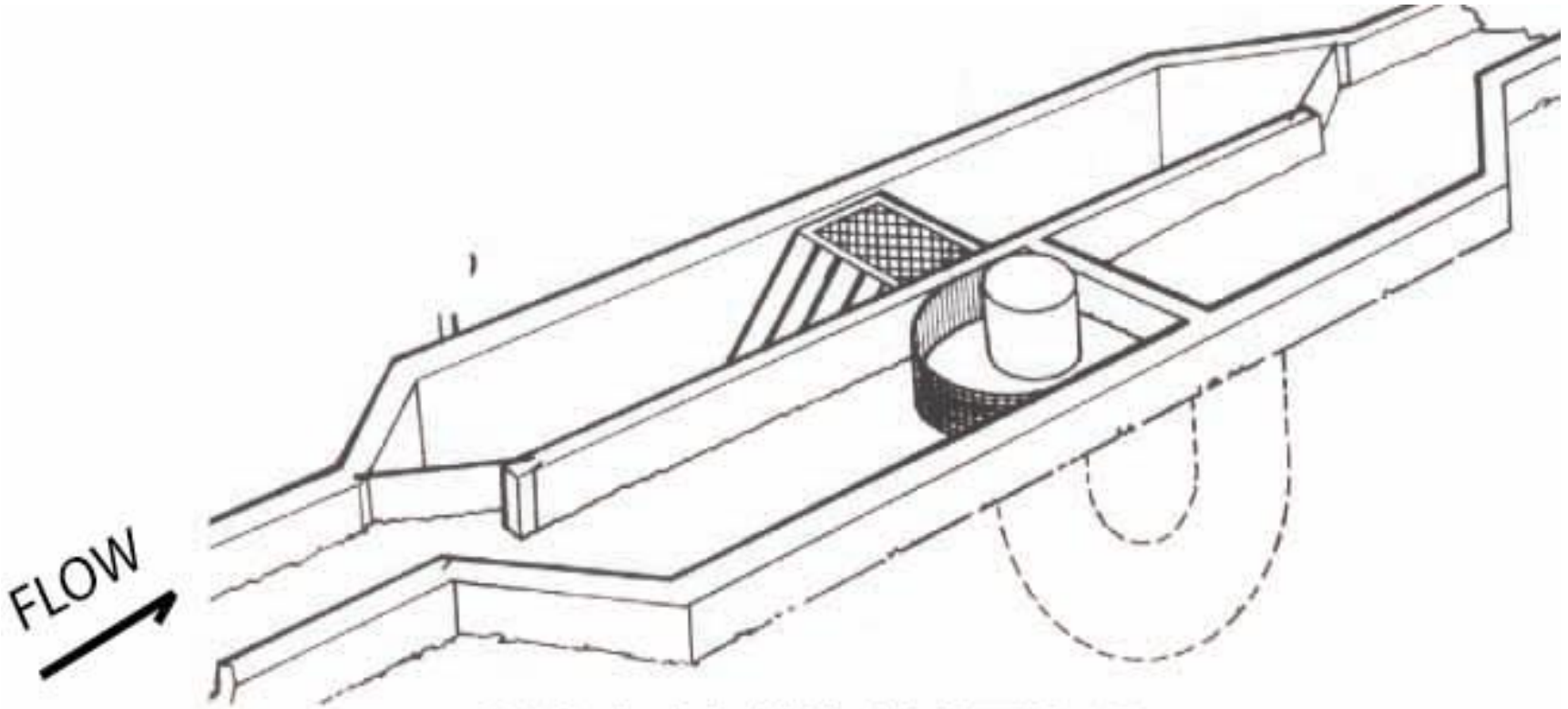


VORTEX (CYCLONE) SEPARATOR

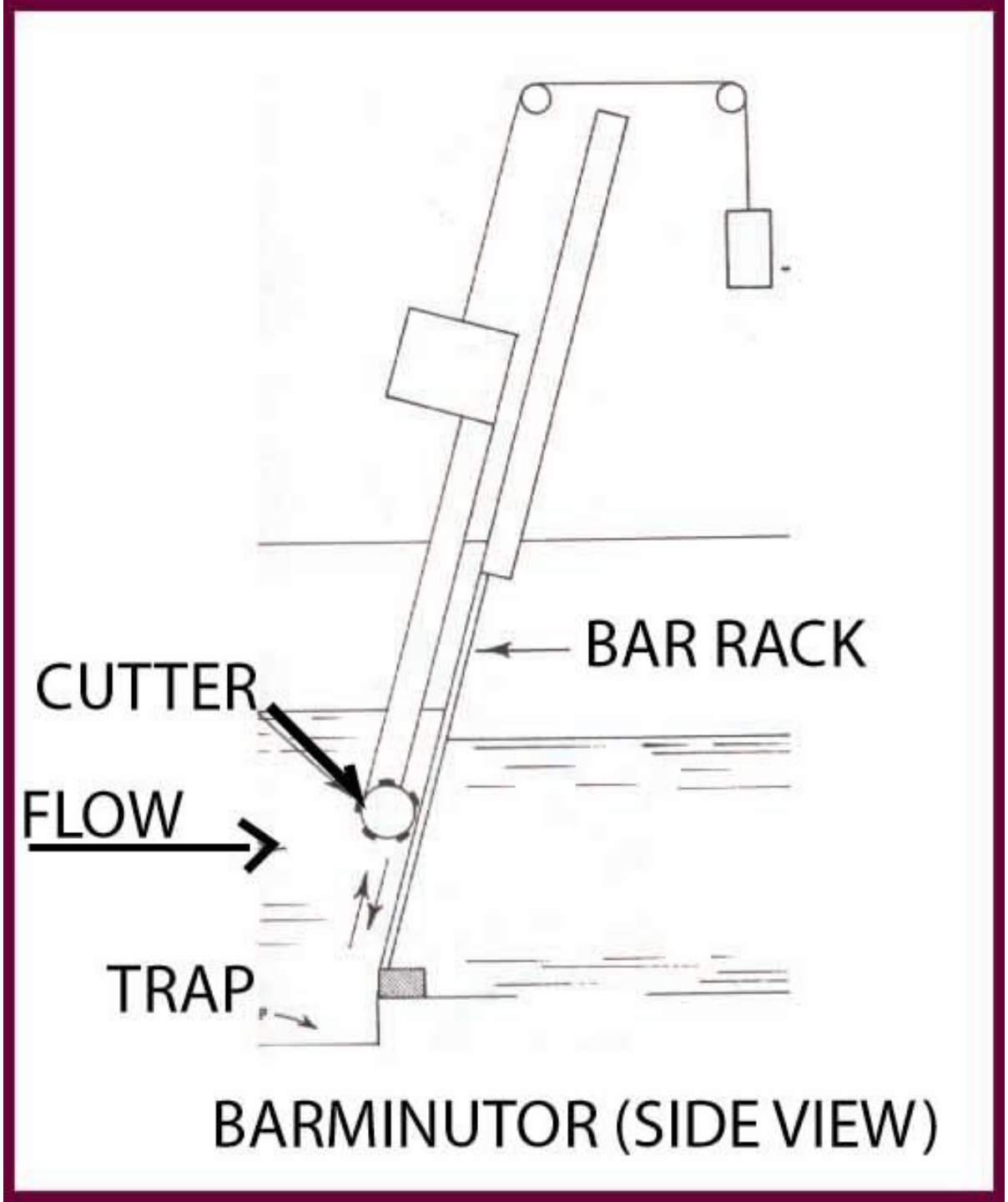
COMMINUTION (SHREDDING)

SOMETIMES…

- **USED IN LIEU OF BAR SCREENS**
- **FOLLOW BAR SCREENS**
- **FOLLOW GRIT CHAMBER**



COMMINUTOR


BAR RACK
CUTTER
FLOW
TRAP
BARMINUTOR (SIDE VIEW)

NEWER TYPES OF SHREDDERS

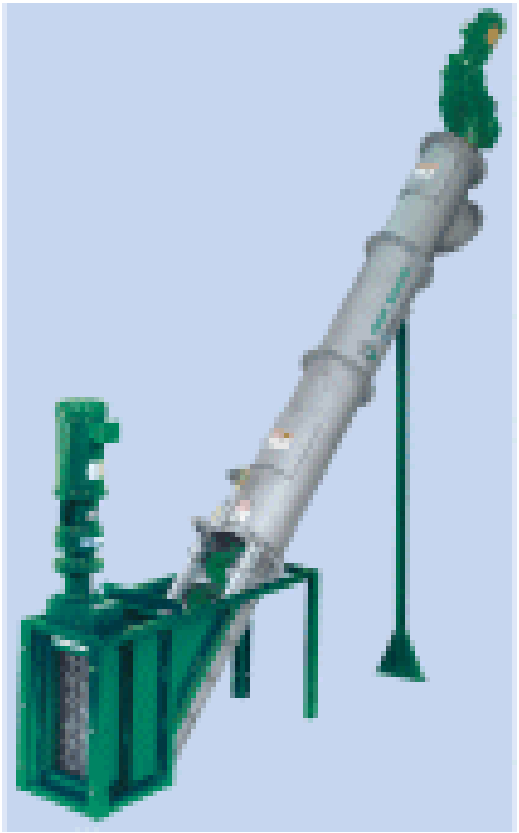
BAR SCREEN MONSTER®

NEWER TYPES OF SHREDDERS

MUFFIN MONSTER®

WIDELY USED IN PRISONS TO PREVENT SEWER BACKUPS

NEWER TYPES OF SHREDDERS



AUGER MONSTER®

OTHERS INCLUDE:
Mini Monster;
Macho Monster,
Channel Monster

NEWER TYPES OF SHREDDERS

DIMMINUTOR®

NEWER TYPES OF SHREDDERS

CHOPPER PUMP