WASTEWATER TREATMENT

Techniques

New Mexico Rural Water Association

2007

Four Process Categories

- **Preliminary Treatment (Pretreatment)**
- Primary Treatment
- Secondary Treatment
- (Tertiary Treatment)

These processes will reduce

settleable solids	BOD
suspended solids (TSS)	pathogens
nutrients	

Preliminary Treatment

Plant Pretreatment

Preliminary Treatment

Physical processes

- Screening
- Grinding
- Grit removal

- Take place at the plant **HEADWORKS** along with **flow measurement**

Screening

Bar Screen

3/8 to 2 inches between bars

Bar Rack or Trash Rack

Greater than 2 inches between bars

Can be **Manual** or **Mechanical**

Manual Bar Screen

Set at 45 degree angle

Mechanical Bar Screen

Typical Angle
60-90 degrees

Microscreen

Purpose of Screens

- To remove sticks and rags
- Dispose of screenings in a sanitary landfill after they pass a “paint filter test” to verify no liquid draining from them
- Incineration is also acceptable in most states

Grinding

- Comminutor

- Barminutor
  - Devices that **shred** incoming rags and debris and leave them **IN** the wastewater

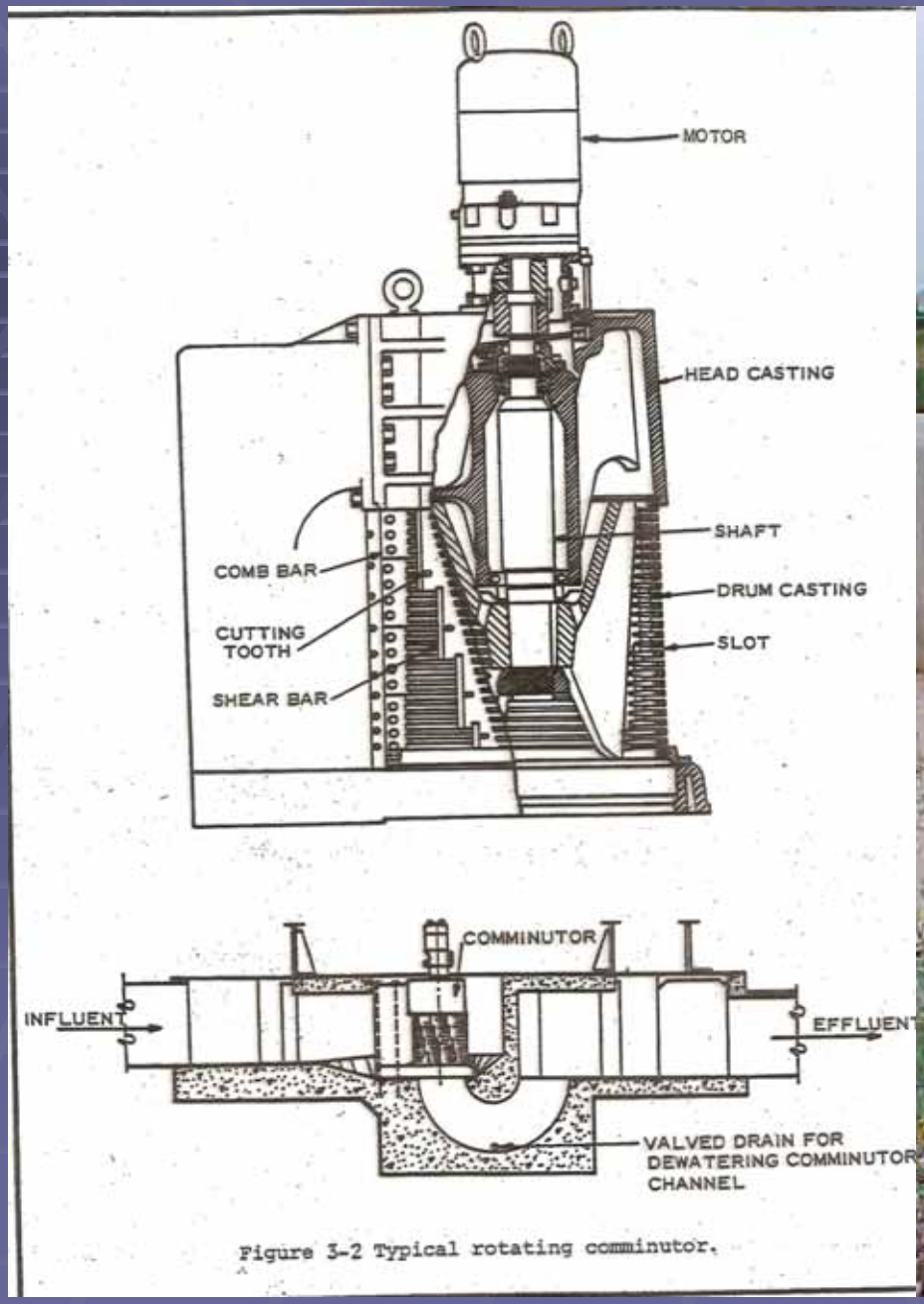
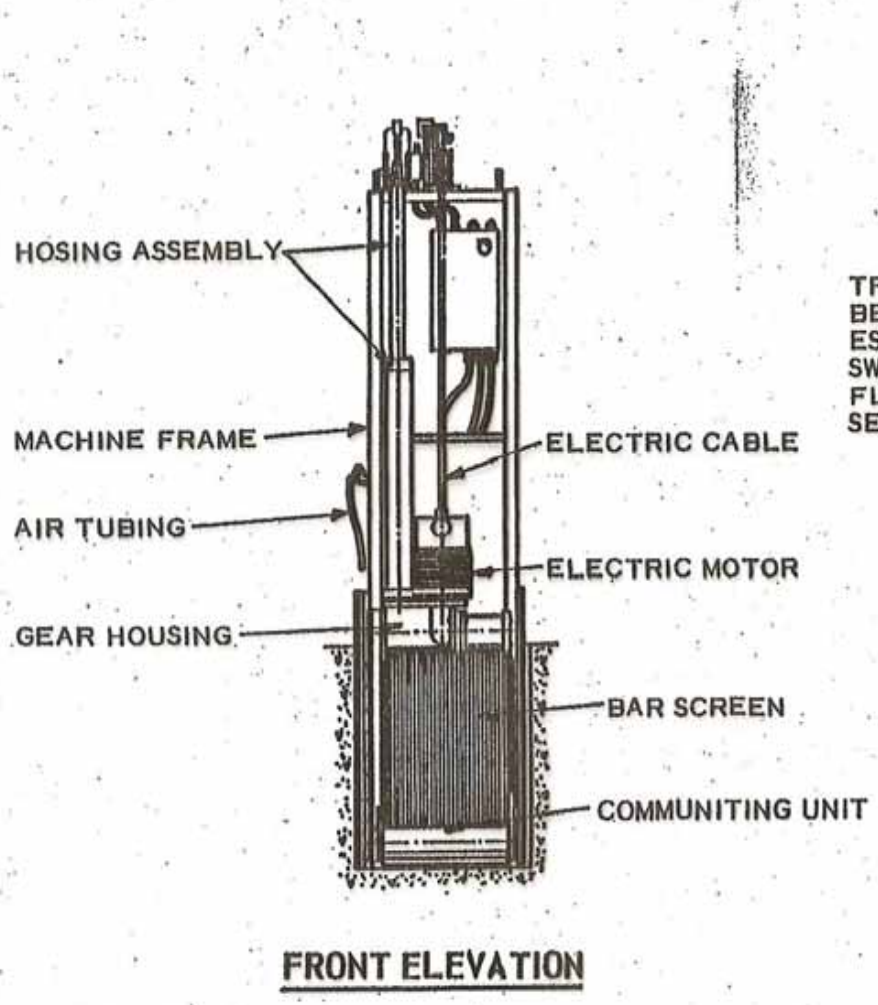


Figure 3-2 Typical rotating comminutor.

Comminutor

Barminutor



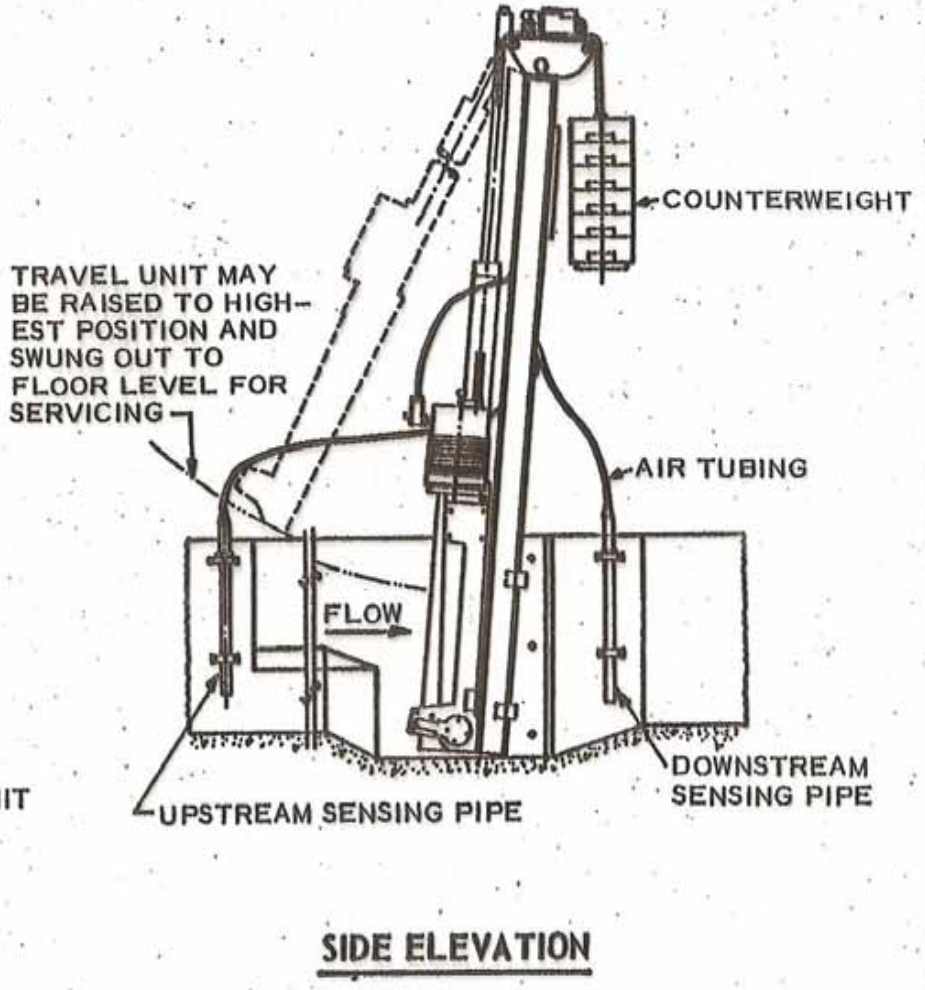


Figure 3-2 Typical bar screen comminutor unit.
(barminutor)

Grit Removal

Eggshells

Sand

Stones

Gravel

Prevents plugged lines, worn pump impellers and grit-filled tanks

Three long - channel grit chambers

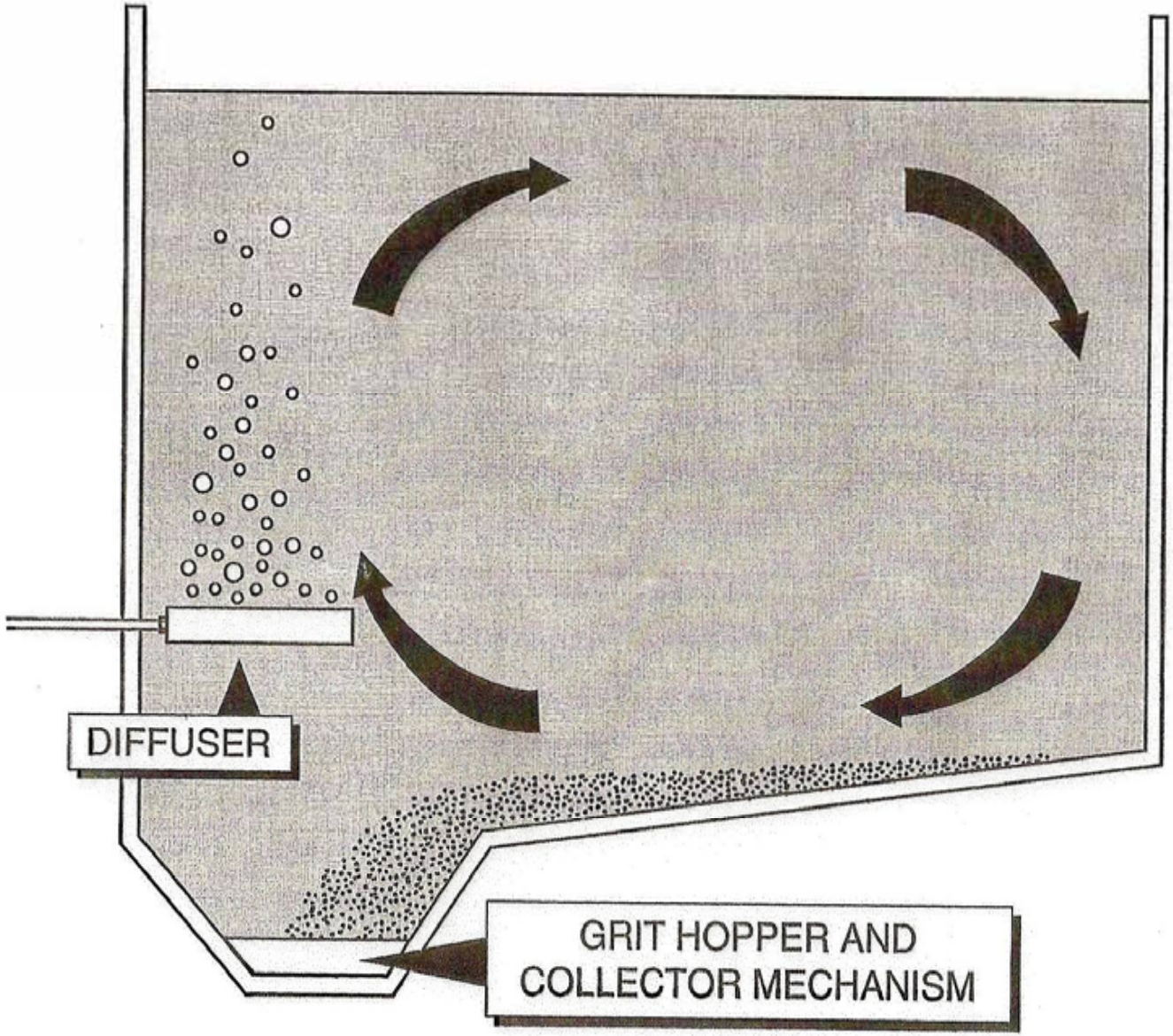
Located after the screening

Proportional weirs to slow flow to 1 ft. per second


Proportional Weir

Aerated Grit Chambers

- Square or rectangular tanks that have air bubbled into one end
- Air/water mix is less dense than water alone
  - Air molecules *push* water molecules aside
  - Causing grit to settle rapidly to bottom



Aerated Grit Chamber

Reduce Specific Gravity of water & centrifugal force

Aerated Grit Chamber

Grit Classifier

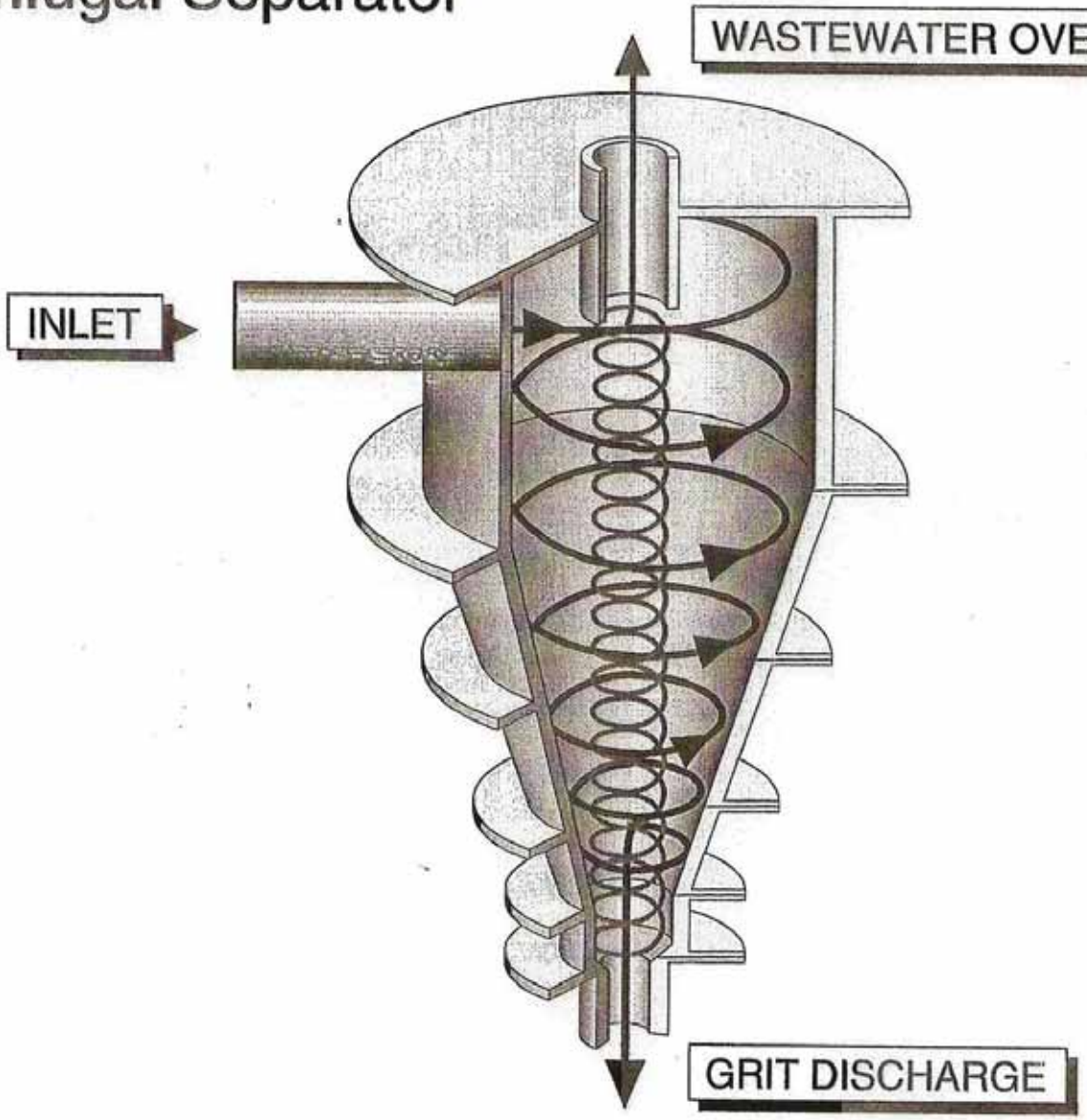
Grit may be concentrated

By a **cyclone separator**

Washed by a grit classifier to remove organic material

Dewatered and collected in a hopper for disposal

Centrifugal Separator



Disposal

- Landfill


Wastewater
Overflow
Grit
Influent


Grit Inlet
Classifier Overflow

Flow Measurement

- **Open channel**
- **Full pipe**

Formula for flow

Q = A X V

Where: Q = Quantity or flow

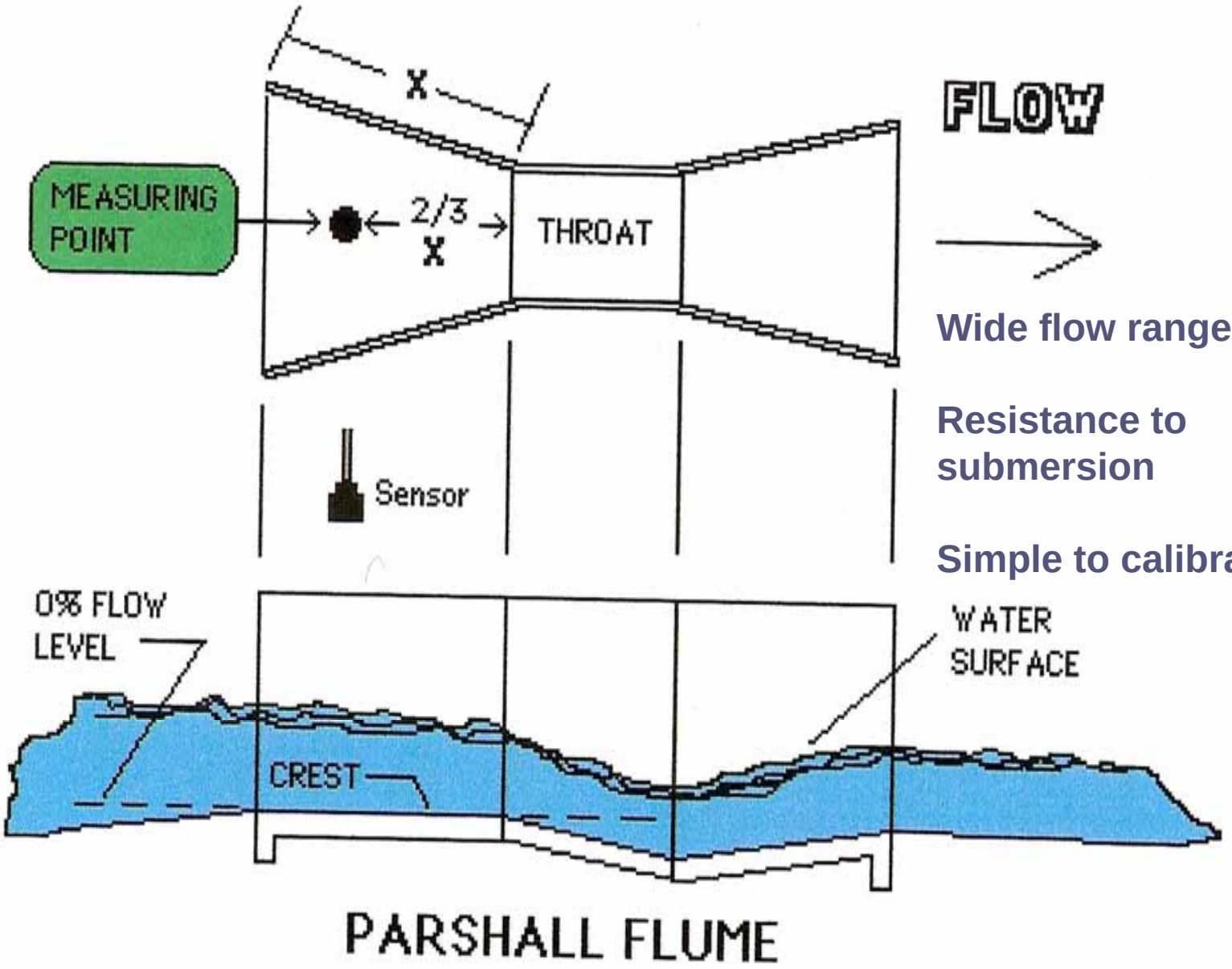
A = Cross sectional area of pipe or channel

V = Velocity of liquid

Common Devices for Open Channel Flow Measurement

- **Flumes**
  - Parshall (most common type in New Mexico)
  - Palmer-Bowlus
  - H-type
- **Weirs**
  - V-notch
  - Rectangular
  - Trapezoidal
- These are ***Primary Flow Measuring Devices***

Most widely used Primary Device in New Mexico



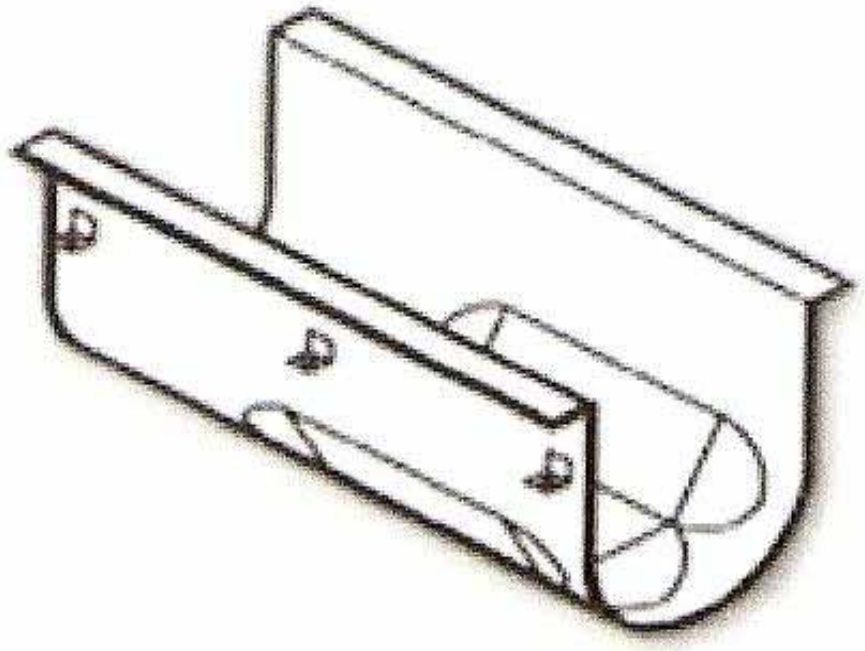
Wide flow range

Resistance to submersion

Simple to calibrate

Parshall Flume

Palmer-Bowlus Flume



Characteristics:

Measurement accuracy

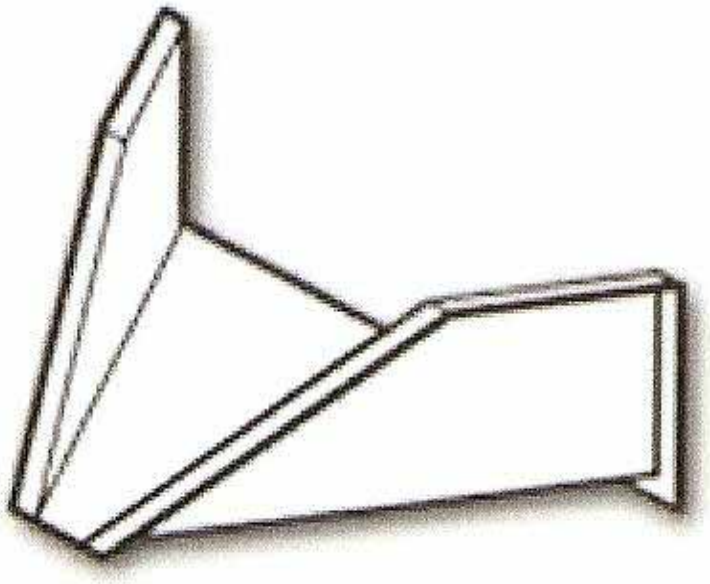
Low head loss

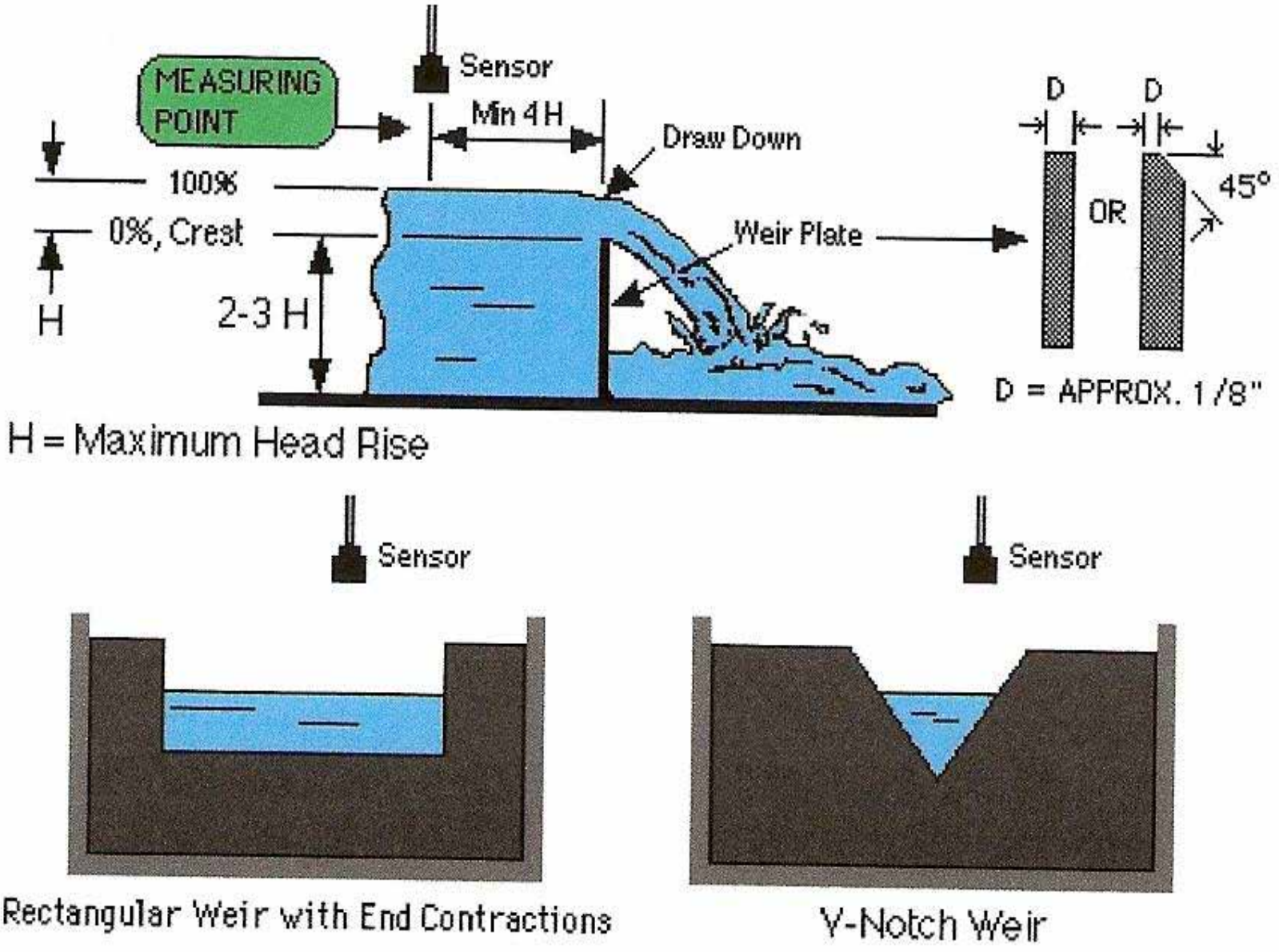
Minimum flow restriction

Ease of installation in pipelines

H Flume

Originally developed to measure agricultural water runoff



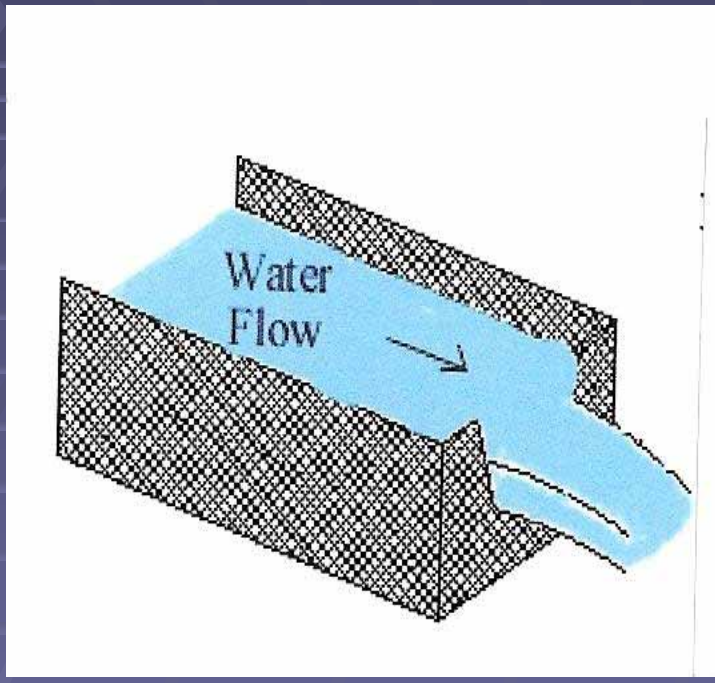


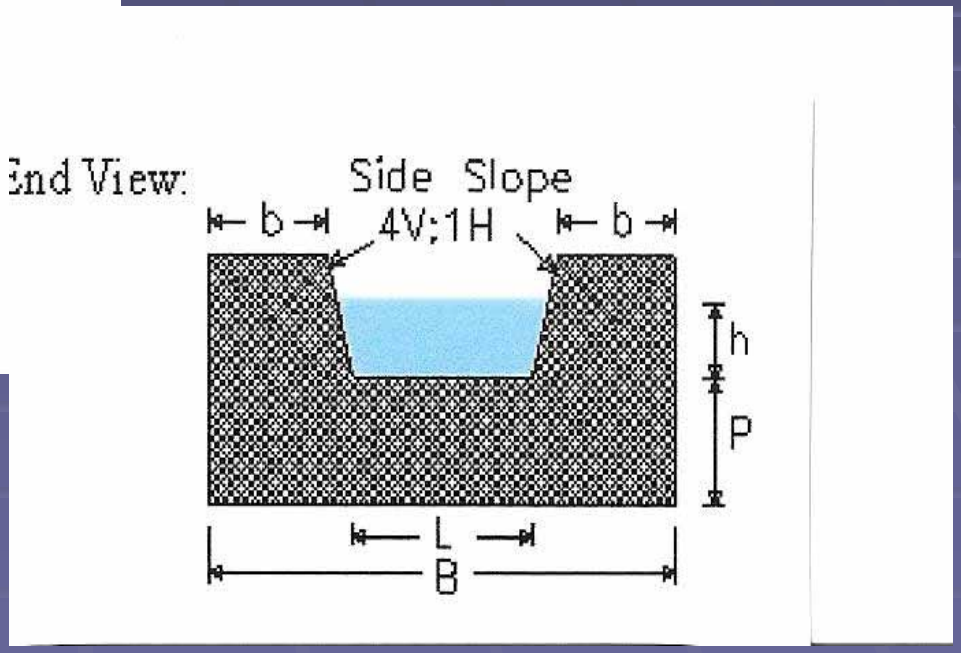
Sharp-Crested Rectangular and V-Notch Weirs


60 degree V-notch weir

Trapezoidal Weir

(Cipoletti Weir)





Common Devices Used in Full-pipe Pumping Systems

- **Venturi meters**
- **Magnetic flow meters**

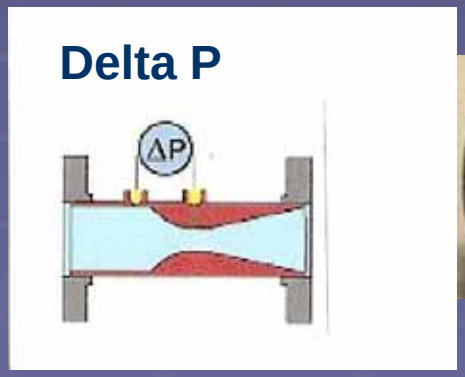
Measure the velocity of the liquid in the pipe

Pipe must be constantly FULL for accuracy

These are also ***Primary Measuring Devices***

Venturi Tube Flowmeter

- The differential pressure element actually forces the flow into a smaller diameter section of pipe, then measures the pressure differences between the unrestricted flow and the restricted flow.



Delta means “difference”

Magnetic Flowmeter

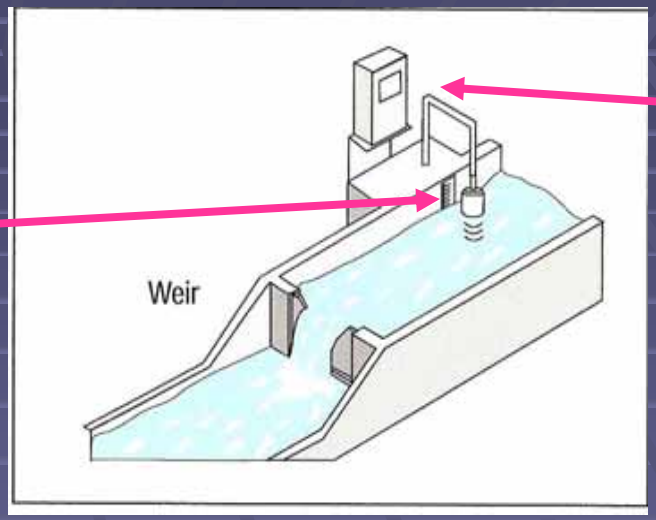
- Based on ***Faraday's Law of Magnetic Induction***
- As a conductive fluid moves faster thru the magnetic field, more voltage is generated. Voltage generated is proportional to the movement of the flowing liquid.

Magnetic coils inside

Secondary Measuring Devices

Transmitting devices

- Ultrasonic transponders
- Bubblers
- Probe-type level detectors



Indicating, totalizing and recording instruments

Units of Measurement

- **Rate of flow** = Volume of liquid that passes a set point in a unit of time

- Common discharge units
  - MGD Million Gallons Per Day
  - gpd Gallons Per Day
  - cfs Cubic feet per second

MORE TIDBITS

The first public toilets for men and women were established in a restaurant in Paris in 1739.

Another word for toilet paper is **bumf**, which is short for bum fodder.