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Innovation

Performance

Caring Relationships

Principles of Filtration

Filtration in Irrigation

- Role of filtration in an irrigation system
  - **Filters remove *suspended particles*** that clog emission devices and hardware
    - Drip emitters, jets, misters/foggers, micro-sprinklers,
    - Valves, air vents, injection quills
- Filters in Irrigation are Mechanical Filters
  - Remove ***suspended particles*** in the water such as sand, algae, and organic matter
  - CANNOT remove **dissolved solids** in the water, such as salts, iron, and manganese

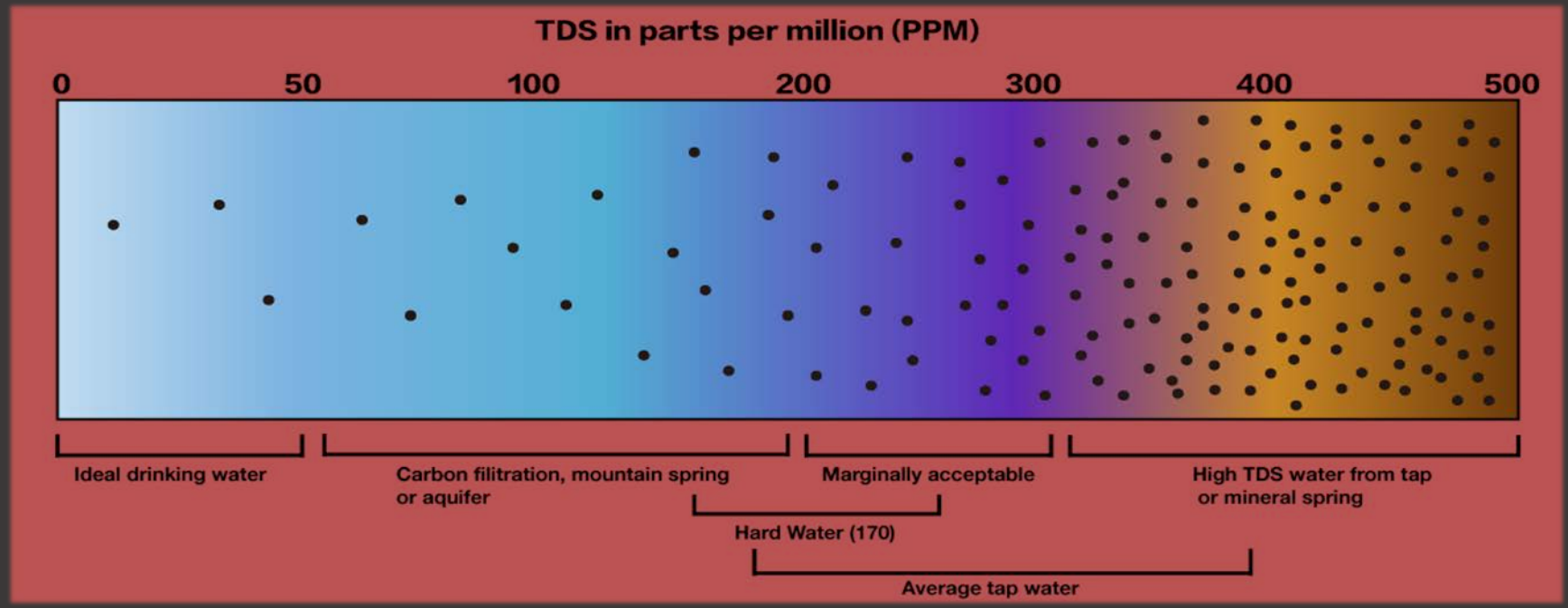
Water Quality in Filtration

- Total Suspended Solids (TSS)
  - TSS are solids that remain intact when added to water.*
    - Sand
    - Silt
    - Clay
    - Gravel
    - Algae & Bacteria
  - If a 1.5 micron filter stops a particle, it is considered suspended

*Hamilton, D., & Zhang, H. (2016). Solid Content of Wastewater and Manure. OK State Extension, BAE-1759.

Water Quality in Filtration

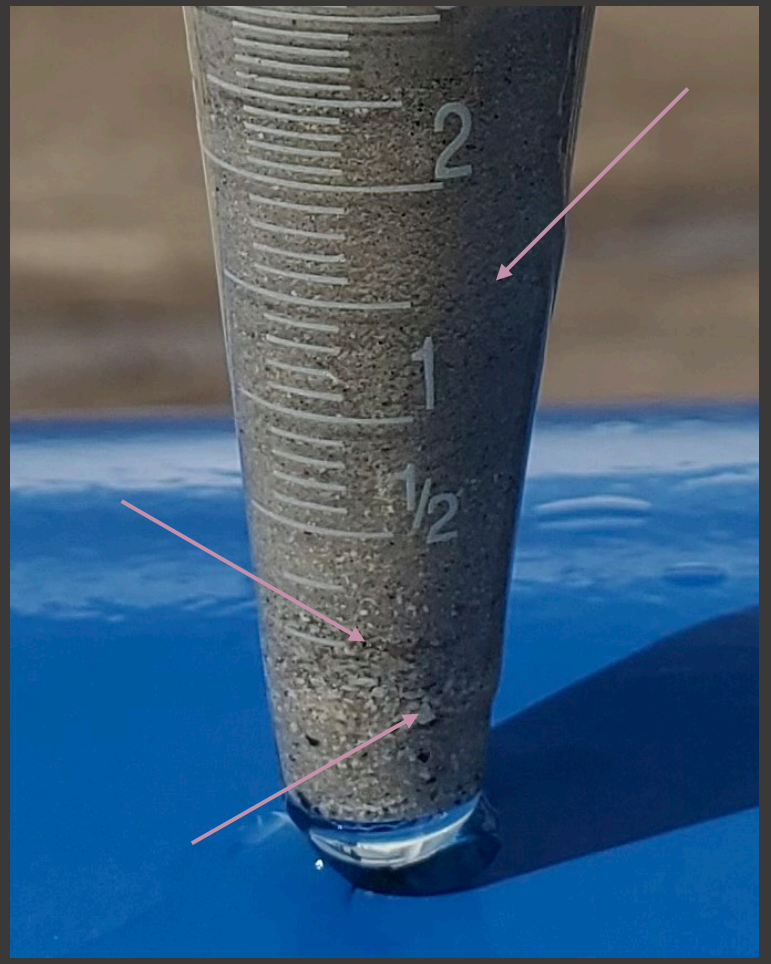
- TDS
  - Total Dissolved Solids (TDS) only appear as solid material when the sample is dried. .
  - They are related to conductivity, salinity, alkalinity and measure the hardness
  - Particulate amount measured in mass/volume (mg/l) or mass/mass basis (ppm)
    - 1000g/l = density of H_20 => 1,000,000 mg per liter (PPM)



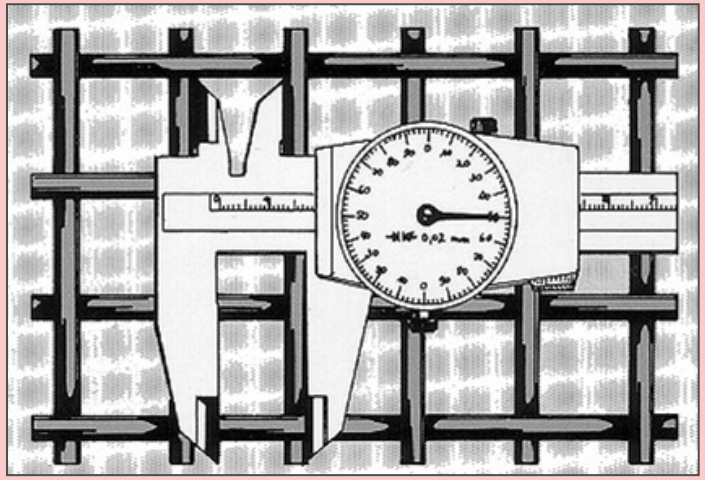
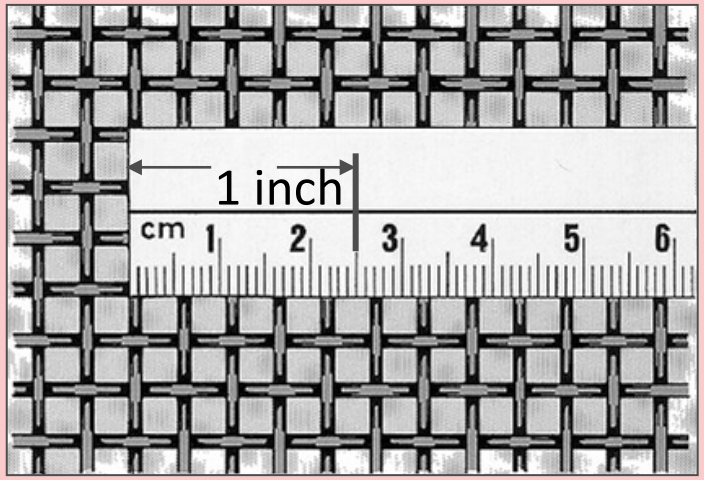
Water Quality in Filtration

- Particle Size Distribution (PSD)

  PSD testing enables you to evaluate the expected quantity and size of organic and inorganic solids in the water that could potentially clog emitters.



Filtration Grade

Micron	Mesh
Actual size of pores in filtration medium in mm or micron. [1 micron (1µ) = 1/1000 mm]	Number of strands or wires per linear inch of screen.
	

Mesh / Micron Chart

Inches	Mesh	Micron
0.0003	1500	10
0.0007	650	25
0.0009	550	30
0.0016	400	40
0.0020	300	50
0.0029	200	74
0.0041	140	105
0.0049	120	125
0.0059	100	149
0.0071	80	200
0.0165	40	400
0.0331	20	800
0.0787	10	1500

* Common screen sizes used for drip irrigation systems

*Filtration requirement for Aqua-Traxx Azul

Determining Filtration Grade

- Protecting Nozzles:
  - What is the diameter of the nozzle?
  - Divide by 3
  - Look at mesh / micron chart to determine the required filtration grade
  - Example: 0.04 inch nozzle
    - Divide by 3 = 0.0133 Look at Mesh / Micron Chart
- Protecting Drippers:
  - What is the critical dimension in the dripper?
  - Divide by 7
  - Look at mesh / micron chart to determine the required filtration grade
  - Example: Companies don't publish the dimensions of their drippers
- **Follow the guidelines of the manufacturer of the emission device**

Water Quality, Flow Rates, & Mesh

- Dirtier Water — Need More Filter Area
- Higher Flow Rates — Need More Filter Area
- Finer Mesh Rating — More or Less Filter Area?
- Most Automatic Filters require minimum of 30-35 for proper flushing

Maximum Recommended Flow Rates [gpm]

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4" Parallel Short Model AF804NL - Flanged				
Filter Area = 896 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	200	250	300	350
Average	300	325	400	450
Poor	275	300	350	400
Very Poor	175	200	250	300

6" Parallel Long Model AF806NX - Flanged				
Filter Area = 1300 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	550	575	650	700
Average	525	550	625	650
Poor	480	500	600	625
Very Poor	380	400	450	550

10" 2-units of AF808NL- Flanged				
Filter Area = 2600 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	1450	1800	2200	2400
Average	1350	1600	1900	2200
Poor	1040	1200	1500	1700
Very Poor	640	800	1100	1300

4" Parallel Long Model AF804NX - Flanged				
Filter Area = 1300 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	375	400	450	500
Average	325	350	400	450
Poor	275	300	350	400
Very Poor	220	250	300	350

8" Parallel Model AF808NL - Flanged				
Filter Area 1300 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	725	900	1100	1200
Average	675	800	950	1100
Poor	520	600	750	850
Very Poor	320	400	550	650

12" 3-units of AF808NL- Flanged				
Filter Area = 3900 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	2175	2700	3300	3600
Average	2025	2400	2850	3300
Poor	1560	1800	2250	2550
Very Poor	960	1200	1650	1950

6" Parallel Short Model AF806NL - Flanged				
Filter Area = 896 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	425	475	525	625
Average	400	450	500	600
Poor	350	400	450	550
Very Poor	300	350	400	500

10" Parallel Model AF810X - Flanged				
Filter Area = 1815 in²				
Water Quality	80 Micron	100 Micron	130 Micron	200 Micron
Good	900	1000	1200	1500
Average	680	750	950	1150
Poor	530	600	800	1000
Very Poor	330	400	600	800

Maximum Recommended Flow Rates [gpm]

Water Source

vs.

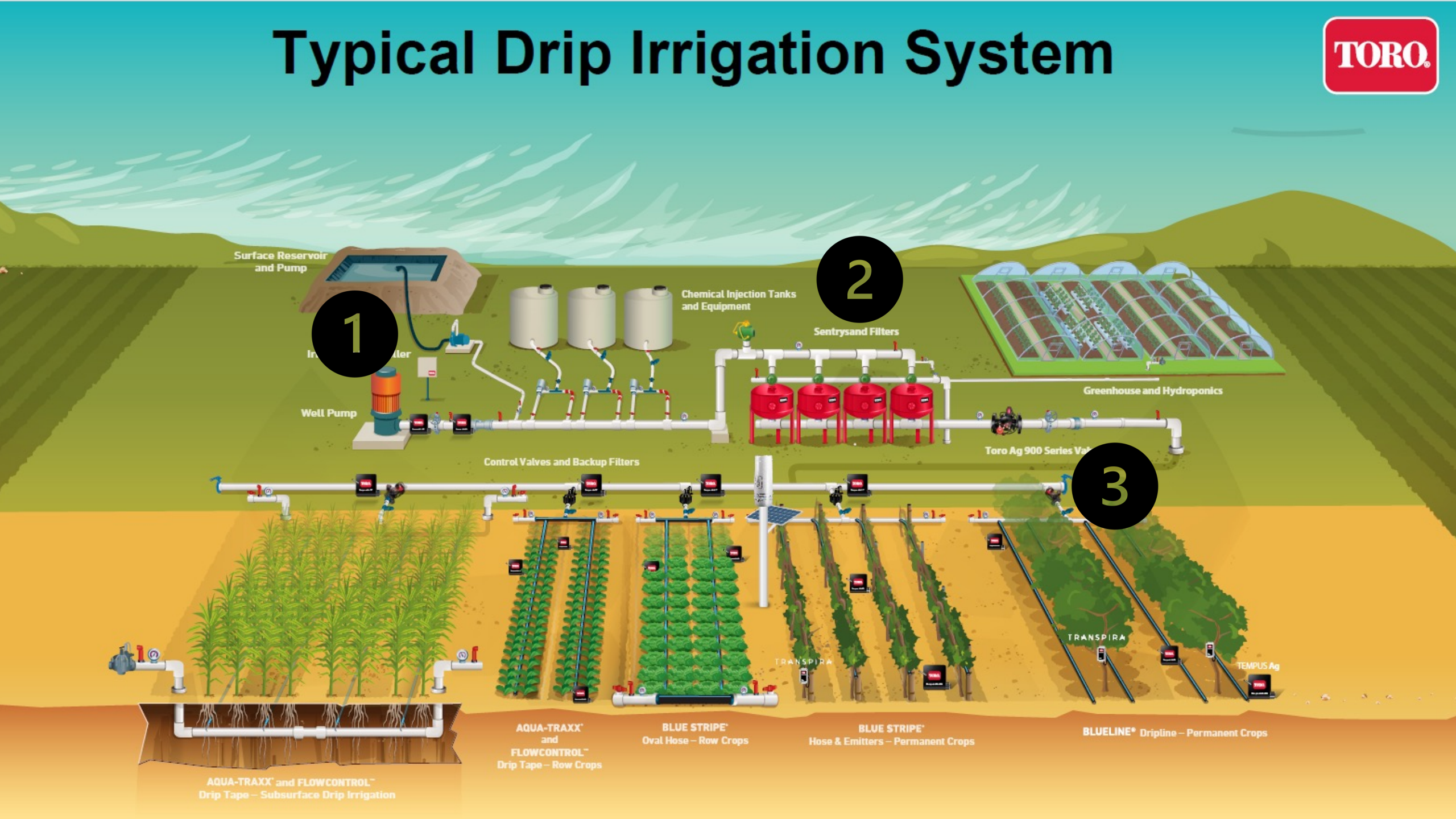
6" Parallel Long Model AF806NX - Flanged				
Filter Area = 1300 in²				
Water Quality	**80 Micron**	**100 Micron**	**130 Micron**	**200 Micron**
Good	550	575	650	700
Average	525	550	625	650
Poor	480	500	600	625
Very Poor	380	400	450	550

Approximately 30% reduction in capacity

Comparing Levels of Technology

	Manual	Semi-Automatic	Fully Automatic
Water Quality	Good	Good - Average	Average - Poor
Solution	Good	Better	Best
Price	Low	Medium	Higher

Typical Drip Irrigation System



Filtration Methods

Sand Media

- Most Comprehensive Filtration
- Well suited for most water sources, even very poor water quality
- Multi-dimensional filtration; most filtration area
- Simple and reliable
- Small amount of moving parts
- Large Footprint, typically requires assembly on site
- Uses large amounts of flush water (flushes for 90 seconds per tank)

Operation of Automatic Media Filter - Video

Filtration Methods

Screen Filters

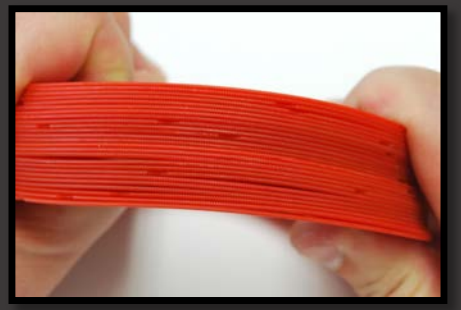
- Versatile Filtration
- Requires frequent flushing in poor water quality
- Short flush cycle (10 seconds)*
- Small Footprint and easy installation
- Uses less volume of flush water
- More moving parts than Sand Media Filters*

*Automatic Screen Filters

Operation of Automatic Screen Filter - Video

Filtration Methods

Disc Filters



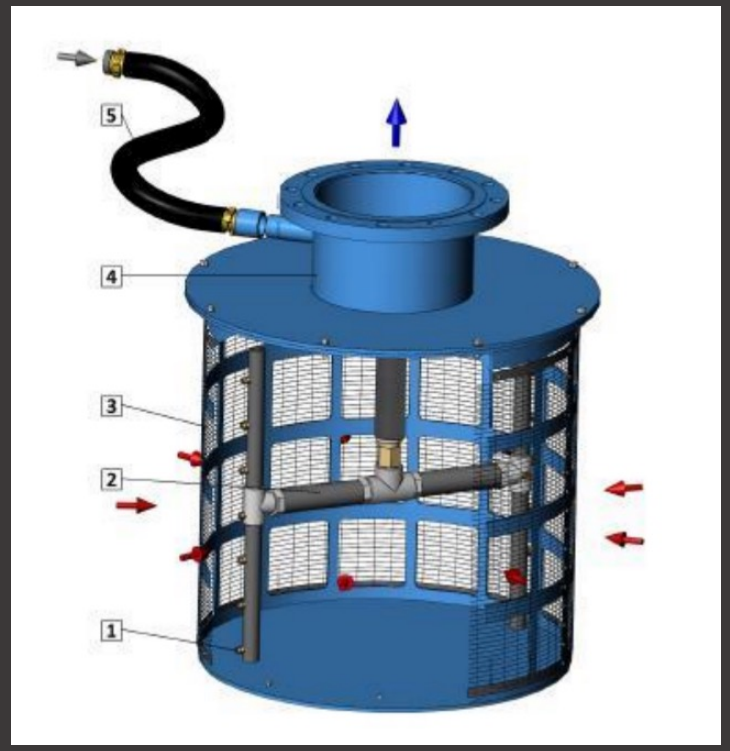
- Effective on surface water with algae and organic debris
- Very sensitive to sand and silt – Will clog quickly
- Small Footprint and easy to install
- Less flush water than sand media, but more flush water than Automatic Screen Filters
- High number of moving parts

Hydrocyclone

- Not considered a filter, because it does not have a filter element
- Causes a constant pressure loss of 5-12 psi

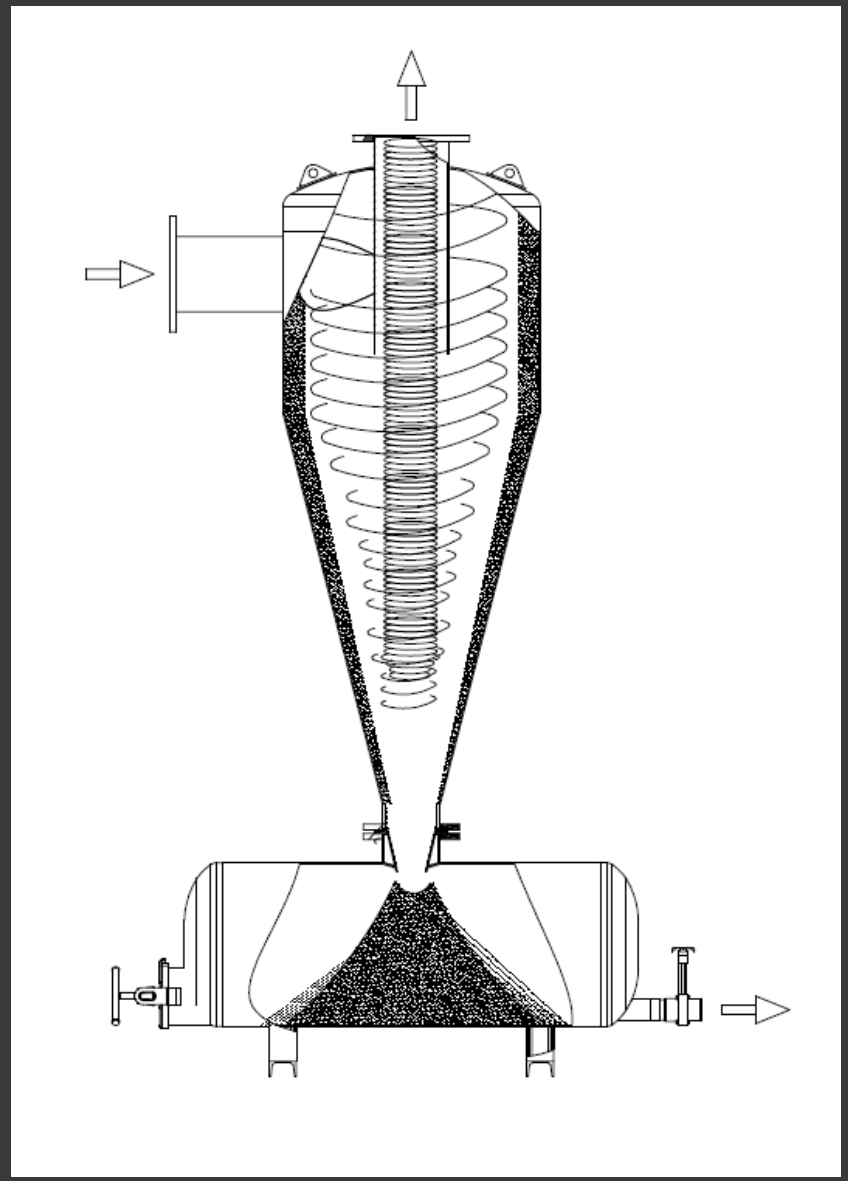
Pre-Pump Strainer

- First opportunity for filtration
- Limited to surface water applications
- Typically connected to foot valve
- Coarse filtrations – 16 or 18 mesh [1200 or 2500 micron]
- Requires pressurized water supply for self-cleaning models.
- Prevents large debris from entering pump and system



Hydrocyclones

- The Hydrocyclone is a mechanical separator of solids particles from liquids.
- Centrifugal force is used for the separation process.
- High spinning velocity moves the particles to the walls of the hydrocyclone.
- The Collection Chamber collects and stores the separated material



Design and Shape of the Hydrocyclone Body

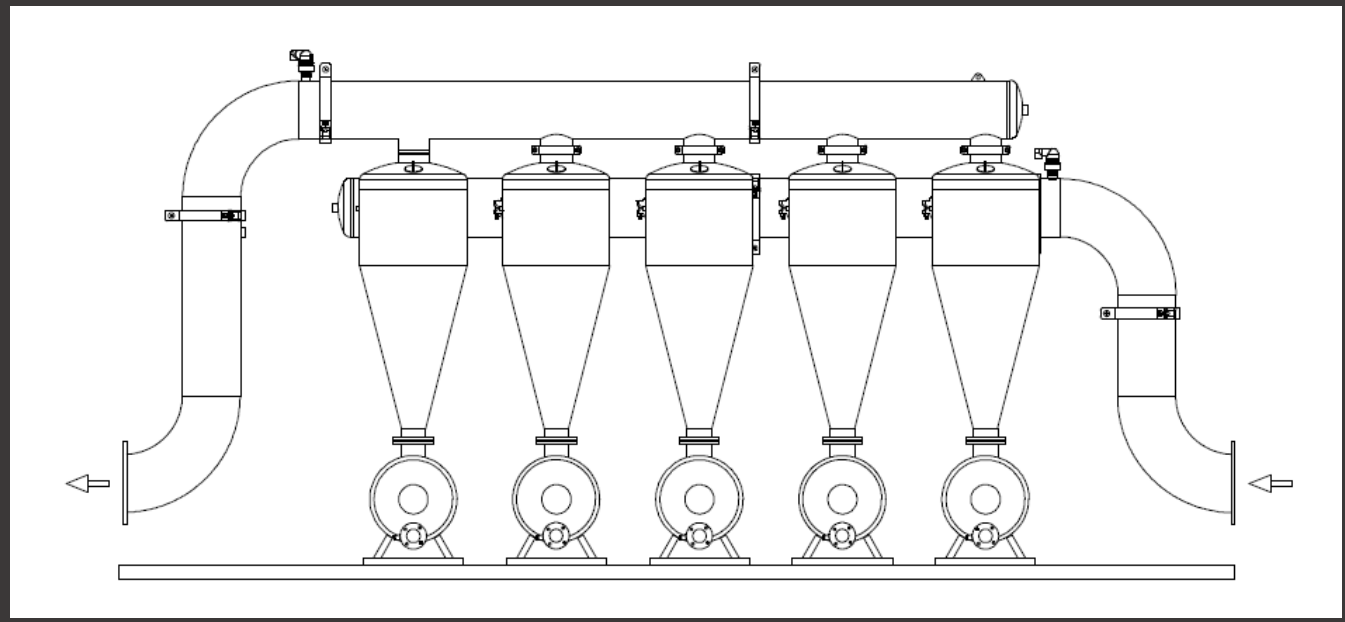
- Velocity of the water will naturally slow down, due to friction of the water spinning against the wall of the hydrocyclone.
- Cone shape maintains high velocity as the water spins down across the body, achieving a higher percentage of separation.
- The greater the velocity, the better the separation.

Hydrocyclone Manifold

Two (2) Reasons to manifold multiple units together:

- **Varied Flow Rates:**
- If the water source has varied flow rates, 2 or more cyclones enable the grower to keep the optimal flow rate per unit by shutting 1 tank off using isolation butterfly valves.

- **Separating Silt:**
- Silt has a very low specific gravity and is more difficult to separate - Greater velocity is required.
- Multiple small model Hydrocyclones, manifolded together, can achieve the higher velocity required to separate the silt.



Hydrocyclone with Auto Flush

- When to use auto flush
  - Greater than 5 ppm of sand
  - Ensures flushing the sand out of the tank before it gets 1/3 full
- Flush by time, not pressure differential:
  - Flush for 10 seconds every hour

Manual F100 Series Steel Screen Filters

Application

- Secondary Filtration - Block filter in the field
- Primary filtration for *Good Water Quality*
- Angle configuration fits row crop fields, can lay on a pallet

Features

- Carbon Steel Epoxy Coated Body
- Stainless Steel Screen supported by a PVC cylinder
- Available Sizes: 3”, 4”, 6”, 8”, 10”
- Includes drain valve to release pressure before opening filter
- Easy to disassemble and clean

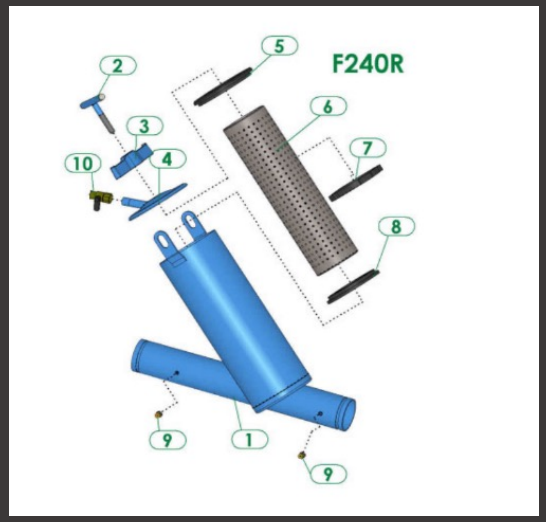
Manual F200 Series Screen Filters

Application

- Primary or Secondary Filter
- For Good Water Quality
- In Line design is common for primary filtration

Features

- Carbon Steel Epoxy Coated Body
- Stainless Steel Screen supported by a PVC cylinder
- Available Sizes: 3”, 4”, 6”, 8”, 10”
- Includes drain valve to release pressure before opening filter
- Easy to disassemble and clean



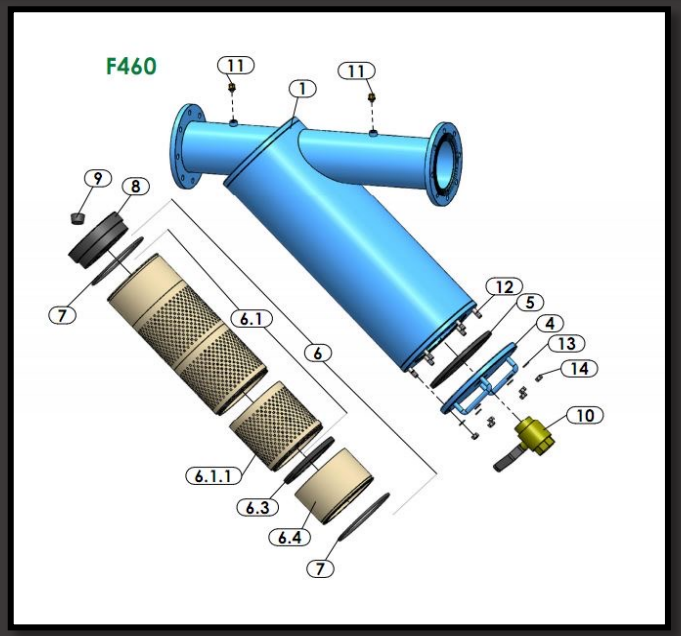
F400 Circulating Screen Filters

Application:

- Well Water with light to moderate amounts of sand
- Reduces the frequency of manually cleaning the screen

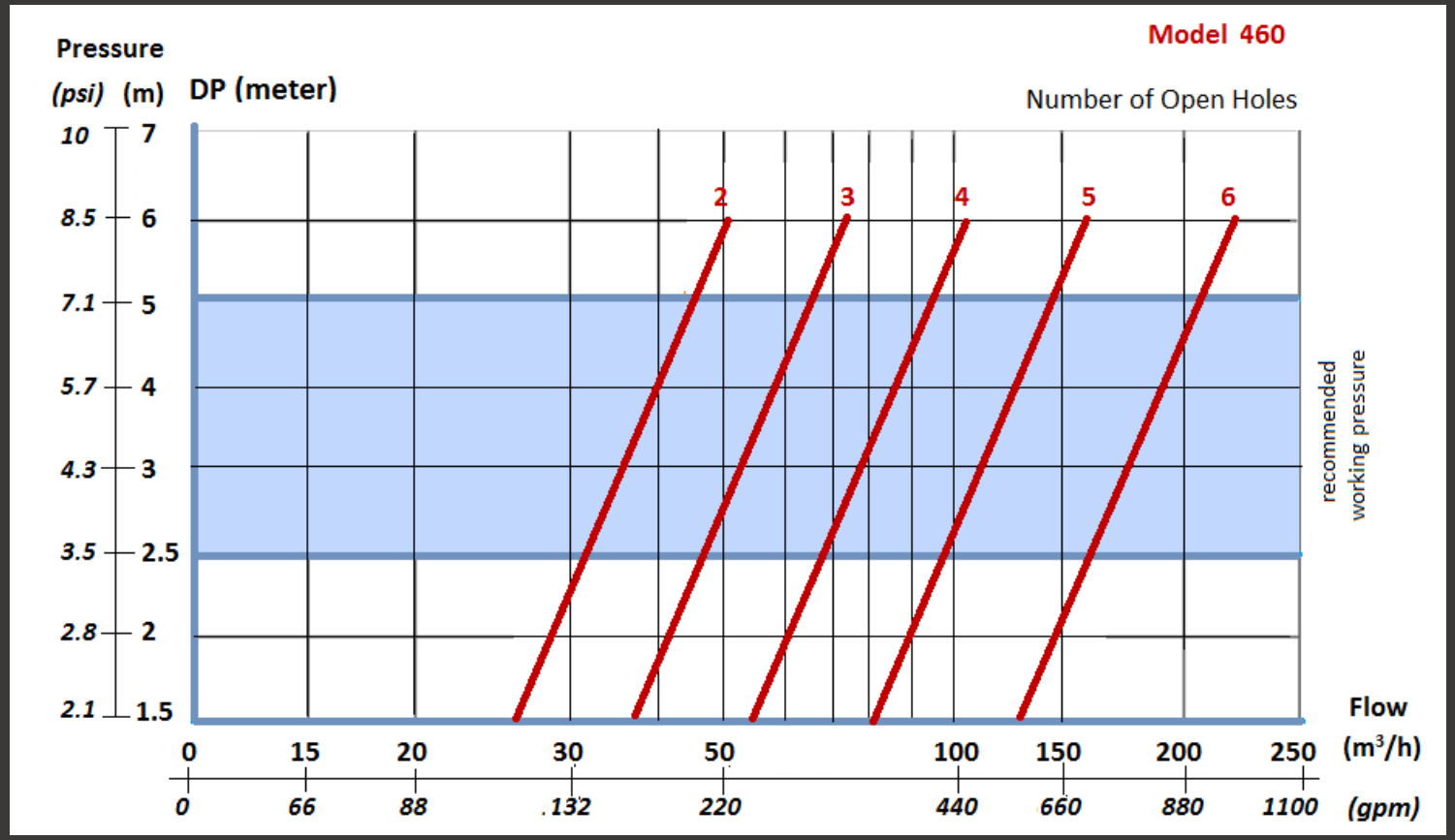
Operation:

- Flow is directed through a circular spin plate with holes
- Causing a spinning motion that pushes heavy particles to the lower section of the filter
- Keeping most of the screen from clogging quickly
- The debris is flushed one of 3 ways



6” F400 Circulating Screen Filter Model

- More Open Holes for higher flow rates
- Less Open Holes for lower flow rates
- Always maintain a 3-5 psi pressure differential when the screen is in a clean state



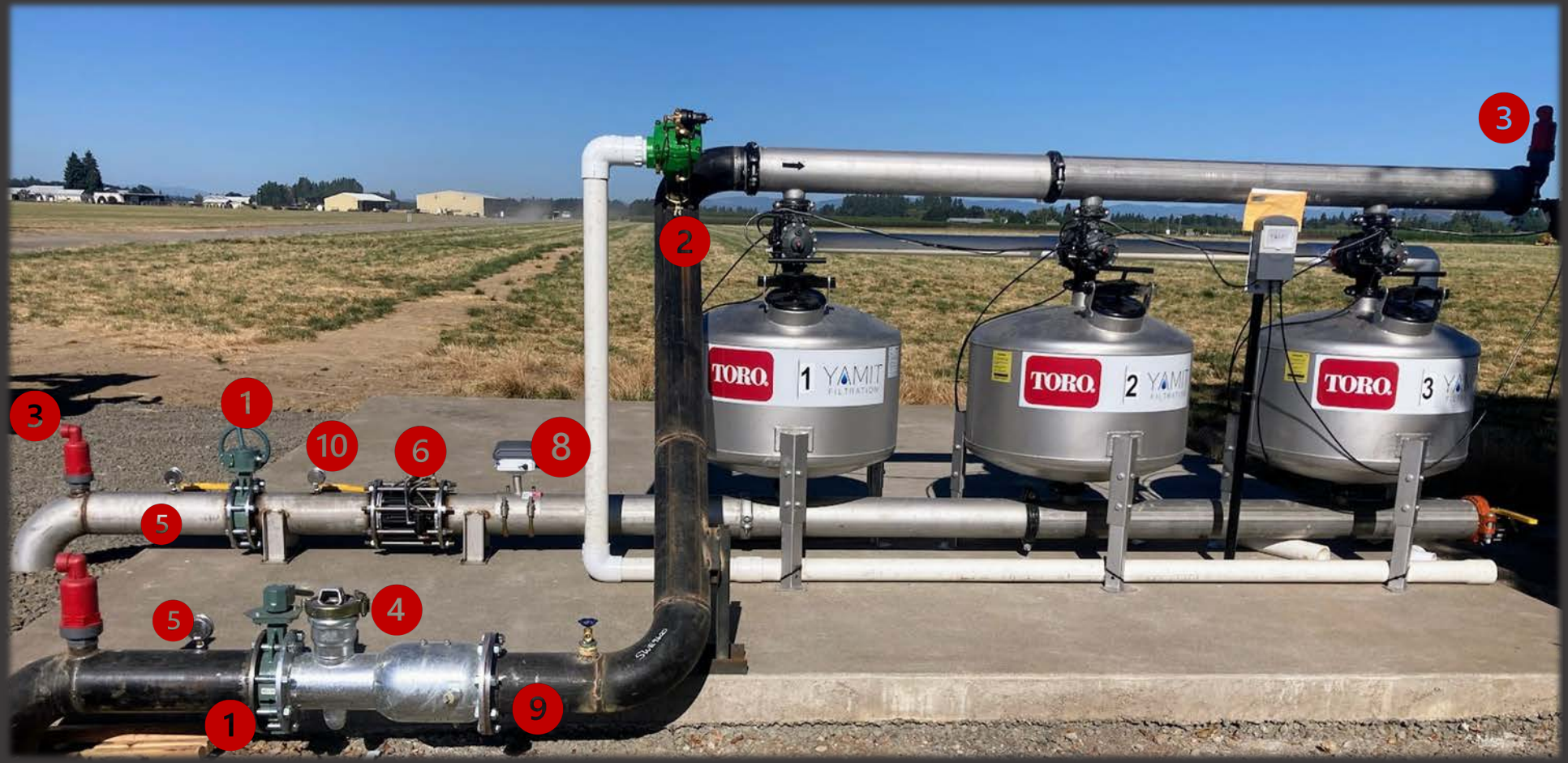
Ancillary Control Hardware

Common Components

1. Isolation Valves
   - Gate or Butterfly
2. Pressure Relief valve
3. Air & Vacuum Relief valves
4. Chem Check valves
5. Pressure gauges

Optional Components

6. PSNO Valves
7. P. Reg or P. Sust. Valves
8. Flowmeter
9. Injection quill or port
10. Utility poly bolted valves
    - Wafer Check valves
    - “Banjo” valve



Key Takeaways

- Know the water quality of the water source
  - TSS
  - TDS
  - PSD
- Filtration requirement for your emission device
- Available flow and pressure
- Local dealer’s preferred method – service and support are critical.

New Sand Media Filtration System

- Fully integrated filtration system (patent pending) – four tanks in one filter body
- Simplified setup with pre-installed valves & connections, fewer components
- Reduced total installation time – hours instead of days to commission
- Reduced materials & labor for site prep
- Permanent, semi-permanent, or mobile applications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