Wet Screening:
“Making Water Work for You”

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President/Owner

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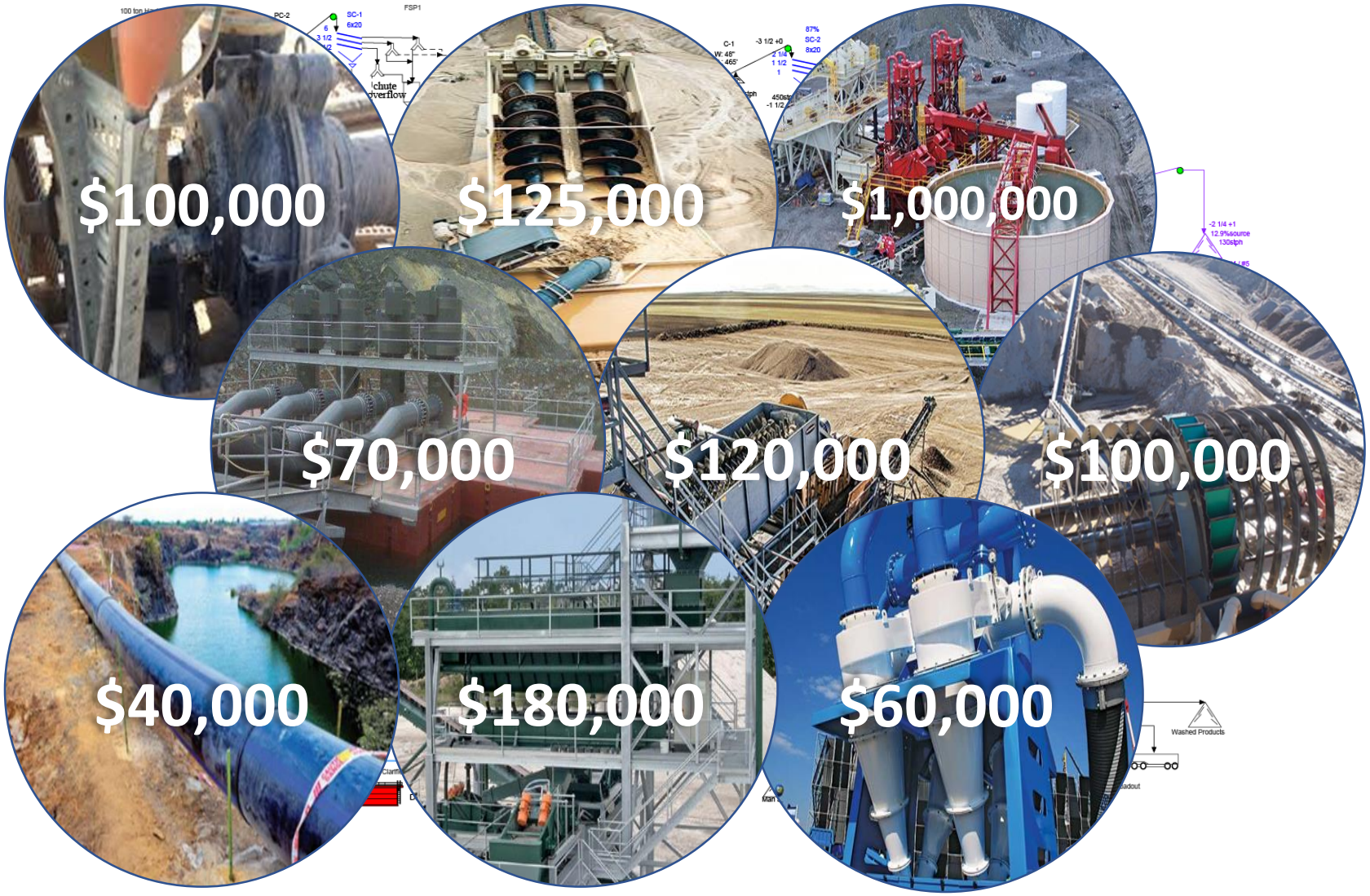
Territory Manager

POLYDECK®

Wet Screening



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Types of Wet Screens

- Wash Screens
- Rinse Screens
- Dredge Screens
- Dewatering Screens

Wash Screens

- Final Sizing of Material
- Using Water to Clean and Size
- Break up clay and eliminate fines
- Consistent Bed Depths (Feed Gradation)

Rinse Screens

- Not Sizing Material – Sized Prior to Screen
- Remove clay and fines
- Fluctuating Feed – Varying Deck Loading
- Inconsistent Bed Depths (Product to Product)
- High bed Depths
- High Amount of Near-Sized Material

Dredge Screens

- Separating Sand - Rock
- High volumes of water
- High Velocity down the Deck
- Velocity Boxes over Screen
- Curtains, Dams, and Flaps used to decrease velocity
- Low bed depths
- Bottom Deck Critical

General Wet Screening Equipment Considerations (wash, rinse, dredge)

Horizontal Screens

- **Pros**
  - ✓ Triple shaft
    - Oval motion stroke
    - High G screening
    - Adjustable stroke length, timing angle, RPM
  - ✓ Consistent Travel Speed
    - Improved efficiency
  - ✓ Horizontal decks
    - Material trajectory
- **Cons**
  - ✓ Slower travel speed
  - ✓ Less access room (repairs)
  - ✓ Potential to spill over sides

Inclined Screens

- **Pros**
  - ✓ Higher travel speed (feed)
    - Thinner bed depth
    - Higher feed capacity
    - Less “surging”/spillover
    - Fines stratify faster
  - ✓ “Tumbling” action
  - ✓ More clearance/access
- **Cons**
  - ✓ Material accelerates down the deck (less efficiency)

Dewatering Screens

- Sand (3/16” minus)
- Lower Moisture Content
- High Bed Depth
- Stackable Material

Advantages to Wet Sizing

Affect of Water on Capacity

Size of Opening	Factor E
1/32”	1.25
1/16”	1.75
1/8”	2.00
3/16”	2.00
5/16”	1.75
3/8”	1.50
1/2”	1.30
3/4”	1.20
1”	1.10

1” = 10% Increase
3/16” = 100% Increase
Finer cuts benefit more from water

Volume of Water Required

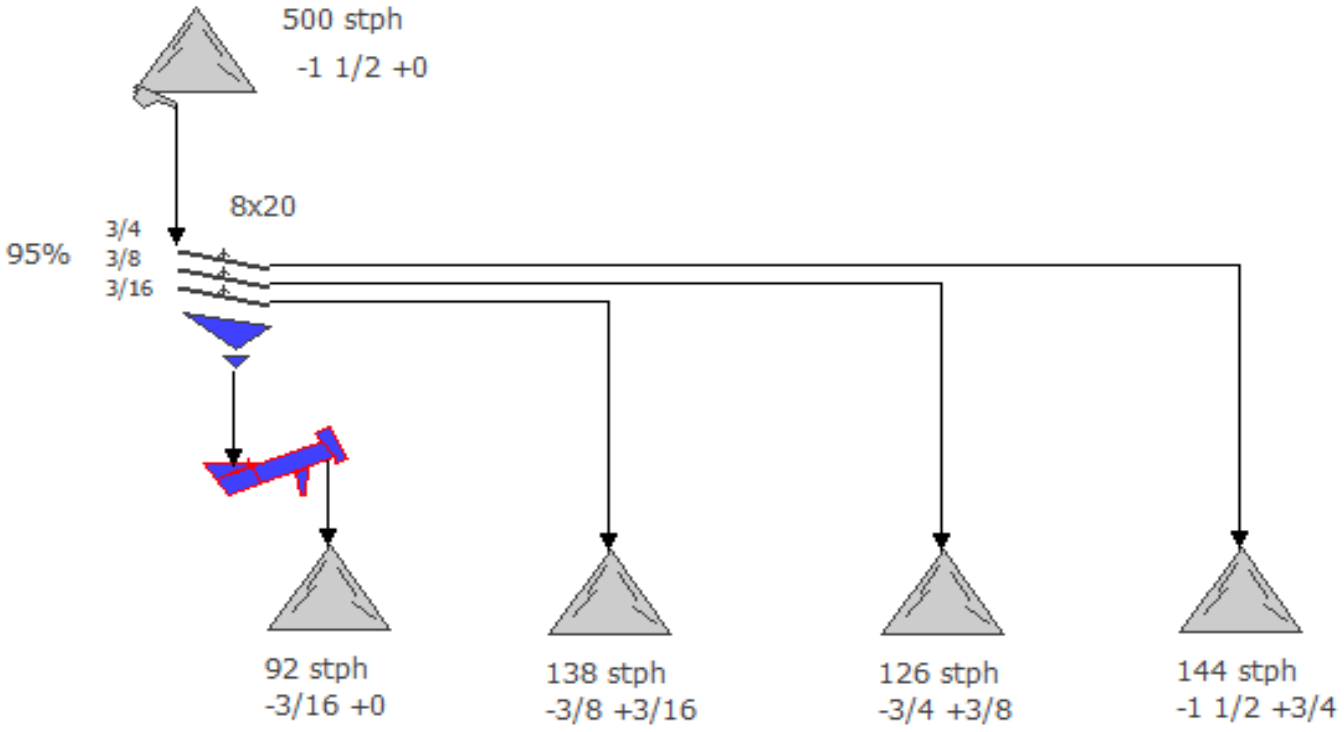
Rule of Thumb: 3-5 GPM per STPH (feed to screen)

Spray Water Requirement for Wet Screening

MATERIAL	APPLICATION	GPM PER TON OF FEED	SPACING OF SPRAYS (INCHES)		PSI
			TOP DECK	BOTTOM DECK	
Stone	Washing	2-4	10-12	7-10	30
Stone	Rinsing	1½-2	10-12	7-10	40
Stone	Rinsing & Rewashing	2-3	10-12	7-10	40
Stone	Sizing	3-5	10-12	7-10	30
Stone & Clay	Washing	5-10	10-12	7-10	40
Sand & Gravel	Washing	3-5	10-12	7-10	30
Sand & Gravel	Sizing	3-5	10-12	7-10	30
Sand & Gravel	Rinsing & Rewashing	2-3	10-12	7-10	40
Sand & Gravel	Media Recovery	2½-3½	10-12	7-10	30
Iron Ore	Sizing	5-10	10-12	7-10	40
Iron Ore	Media Recovery	2½-3½	10-12	7-10	30
Coal	Sizing	3-6	10-12	7-10	30
Coal	Media Recovery	1½-3	10-12	7-10	30
Coal	Prewet	1-3	10-12	7-10	30

5 GPM per ton

Volume of Water Required

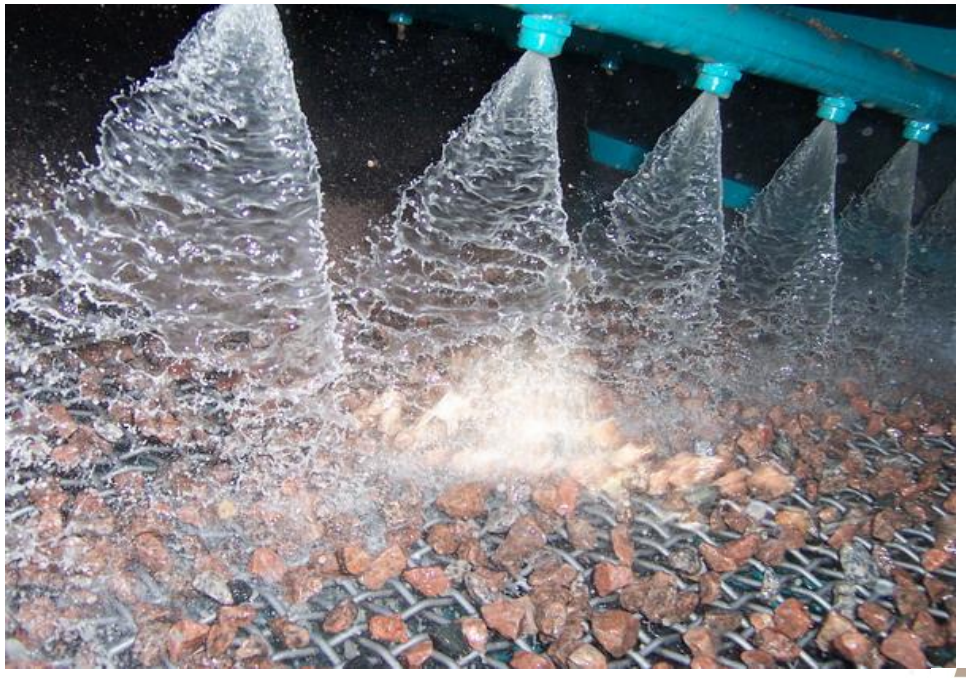


500 TPH X 5 GPM = 2,500 GPM To Screen

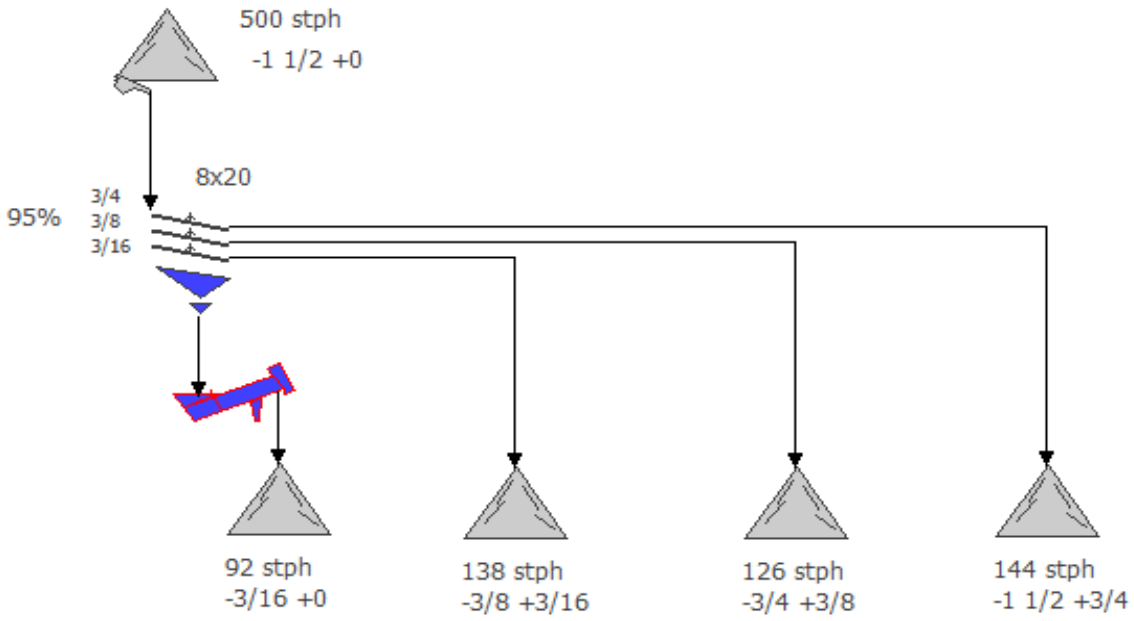
Where to Apply The Water

1/3 of Water into the Headbox

2/3 of Water into the Spray Bars



Where to Apply The Water



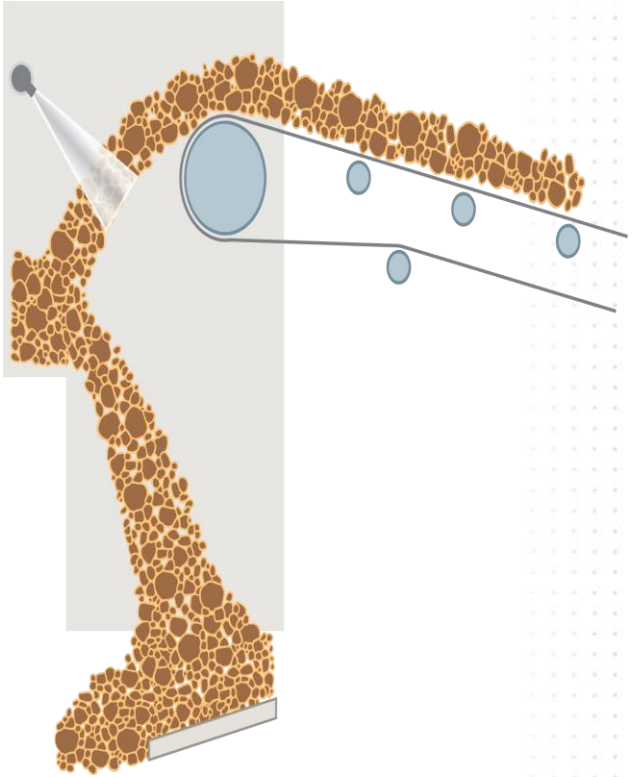
500 TPH X 5 GPM = 2,500 GPM Total To Screen

2,500 GPM X 1/3 = 833 GPM To Head Box

2,500 GPM X 2/3 = 1667 GPM To Spray Bars

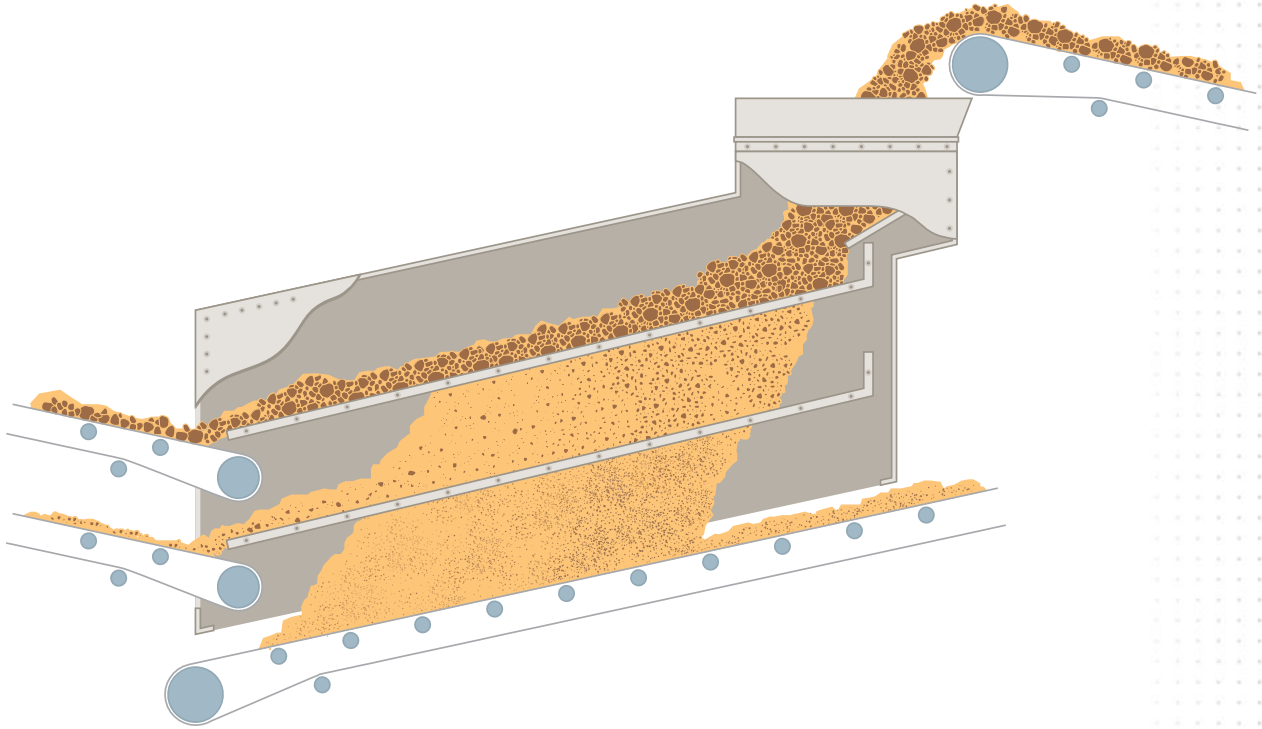
Head Box Water

- Separate Fines from Rock (Slurry)
- Fines/Sand into Slurry Before Screen
- Pre-wet Material
- Soften Clay and Silts
- Increases Efficiency of Screen (up to 50%)
- Increases Capacity of Screen (up to 100%)
- Higher Fines Content = Biggest Gains in Efficiency/Capacity



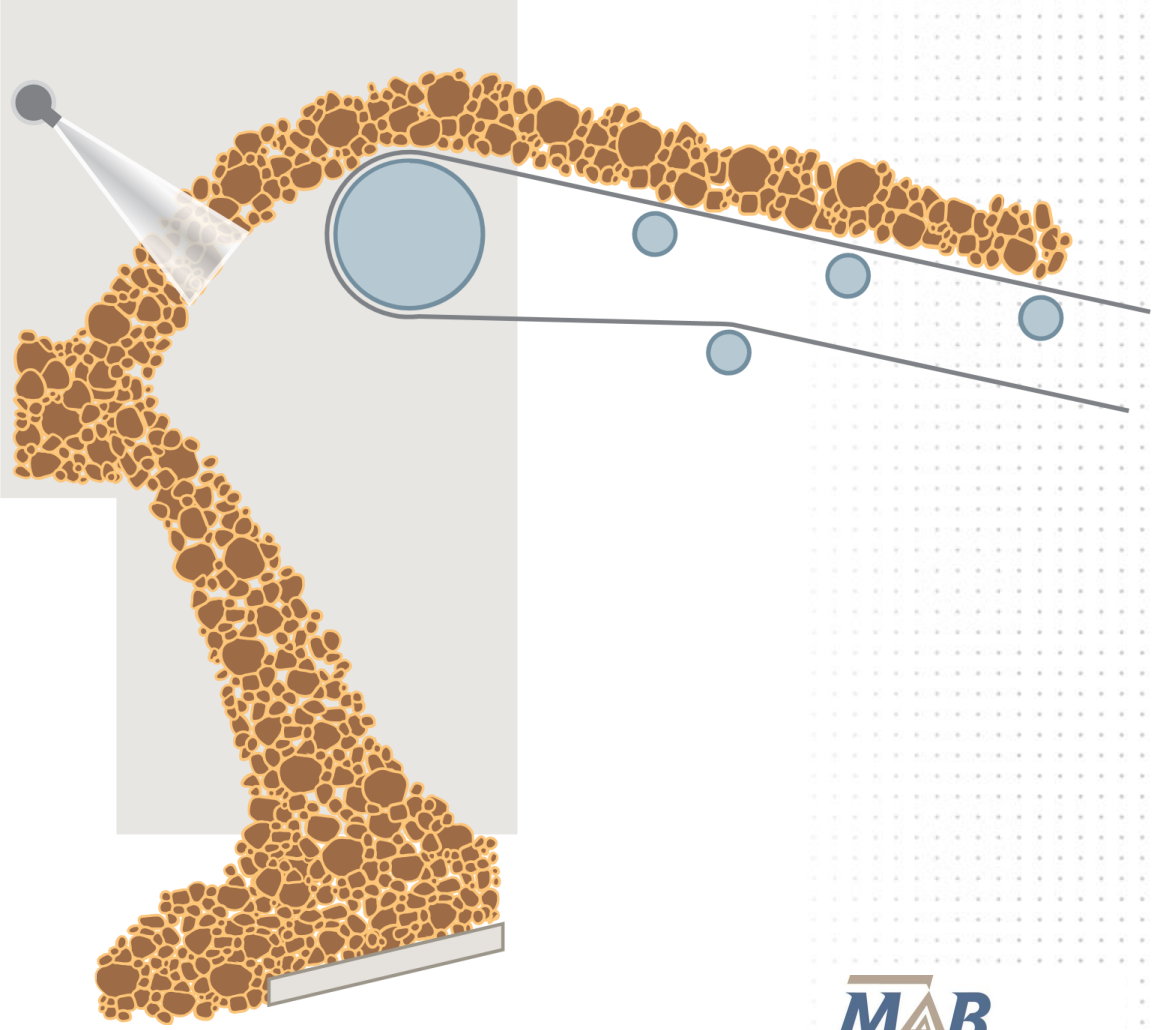
Head Box Water

- Separates Fines from Rock (Slurry)
- Slurry/Sand Reports to Bottom Deck Quicker
- Better Bottom Deck utilization



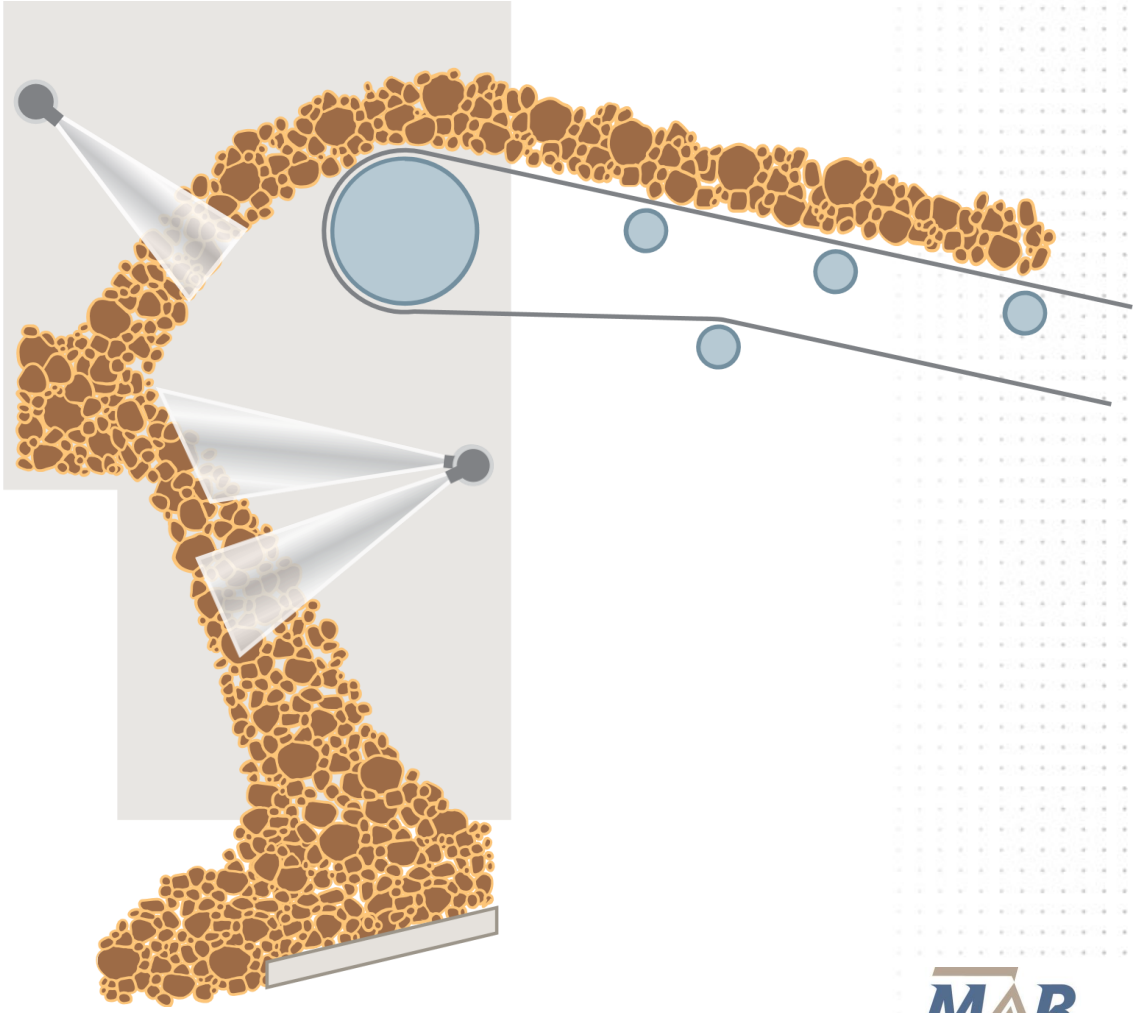
Head Box Water Set-up (a)

- Single Spray Bar Head Box
- Minimal Fines in Feed
- 10% or Less Fines in Feed
- Larger Particle Size (+ 1”)
- Lower Tonnages (-300 STPH)
- Not Effective at Producing Slurry



Head Box Water Set-up (b)

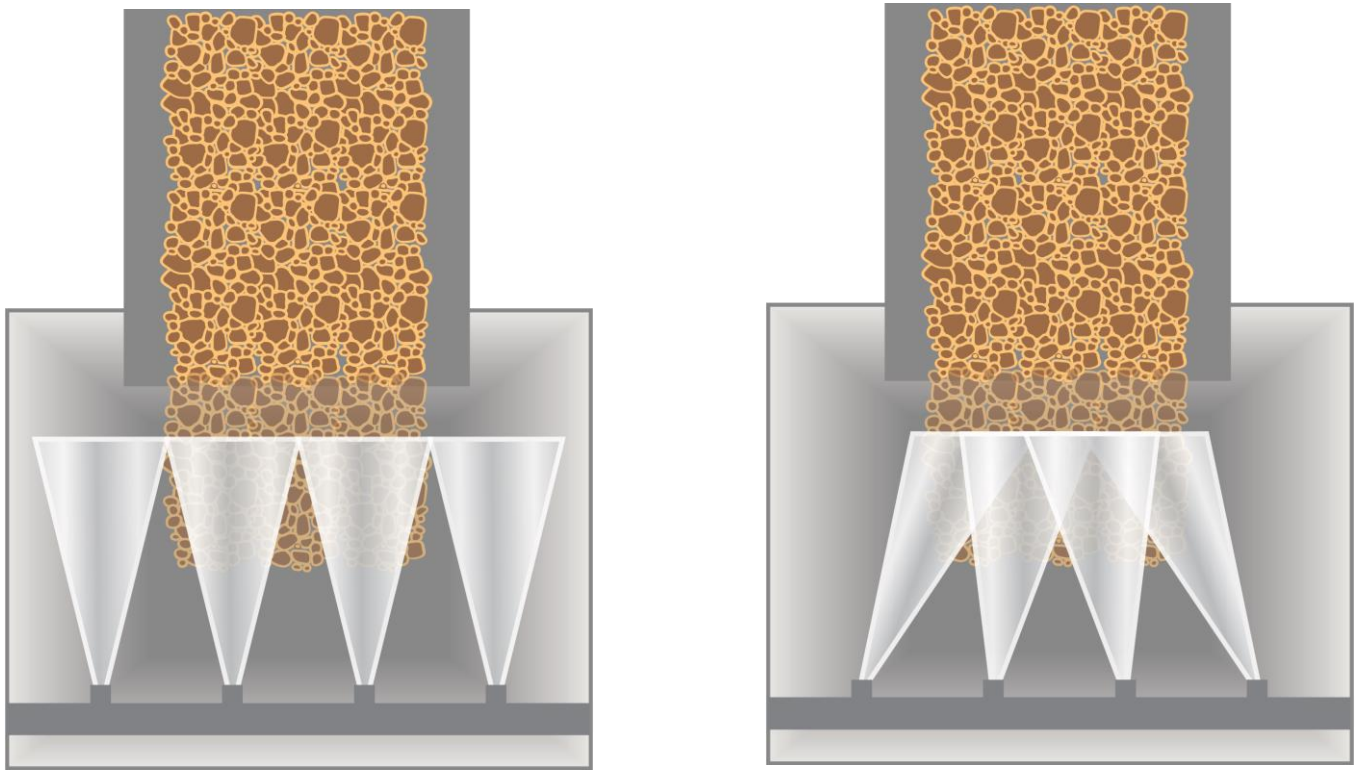
- Double Spray Bar Head Box
- Larger Percentage of Fines in Feed
- More Than 10% Fines in Feed
- Smaller Particle Size (- 1”)
- Higher Tonnages (+300 STPH)
- Effectively Separates Sand from Rock
- Creates the Best Slurry



Head Box Water Set-up

Keep the Water on the Material (Waste)

Poor Water Set-up can be worse than No Water



Pressure Needed to Penetrate Bed Depth

Head Box Water

Head Box Water Problem Indicators

GOOD Head Box Water

- **No Fines Visible on Top Deck**
- **Slurry/Fines to Feed End of Bottom Deck**

POOR Head Box Water

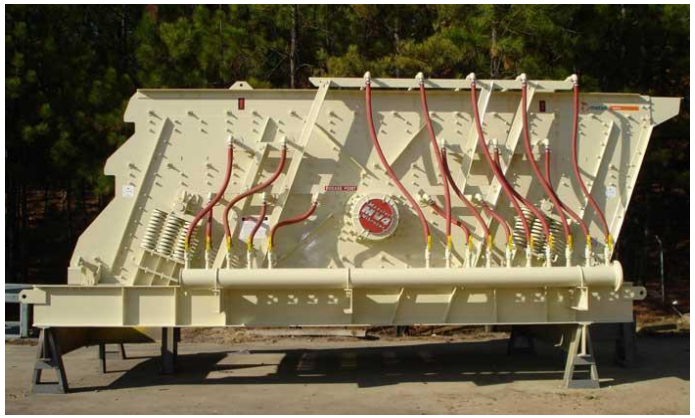
- Dry Fines on Top Deck
- Lumps of Fines on Top Deck
- Clean Water Reporting to Screen
- Dry Fines/Blinding on Bottom Deck

Spray Bars

- Used to Remove Fines from Material (Consistent Gradation)
- Helps Separate Sand/Fines from Rock
- Break up Lumps and Clay Balls
- Reduces Travel Rate of Material (Water Dams)

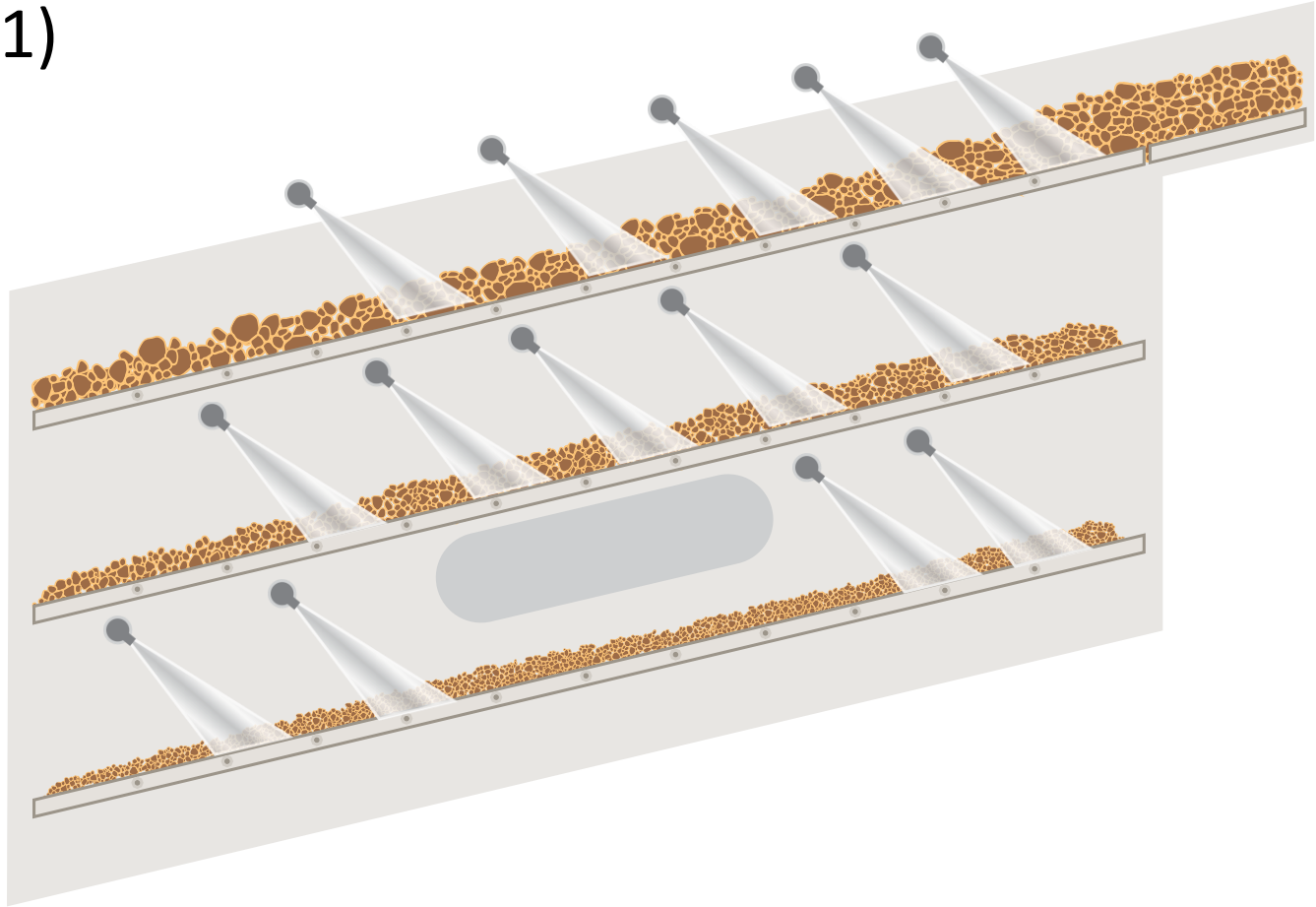
Spray Bar System - Components

- Water Manifold – Divides Flow
- Shut Off Valve
- Water Hose
- Spray Bar
- Nozzles
- Blow Out/Cleaner Valve



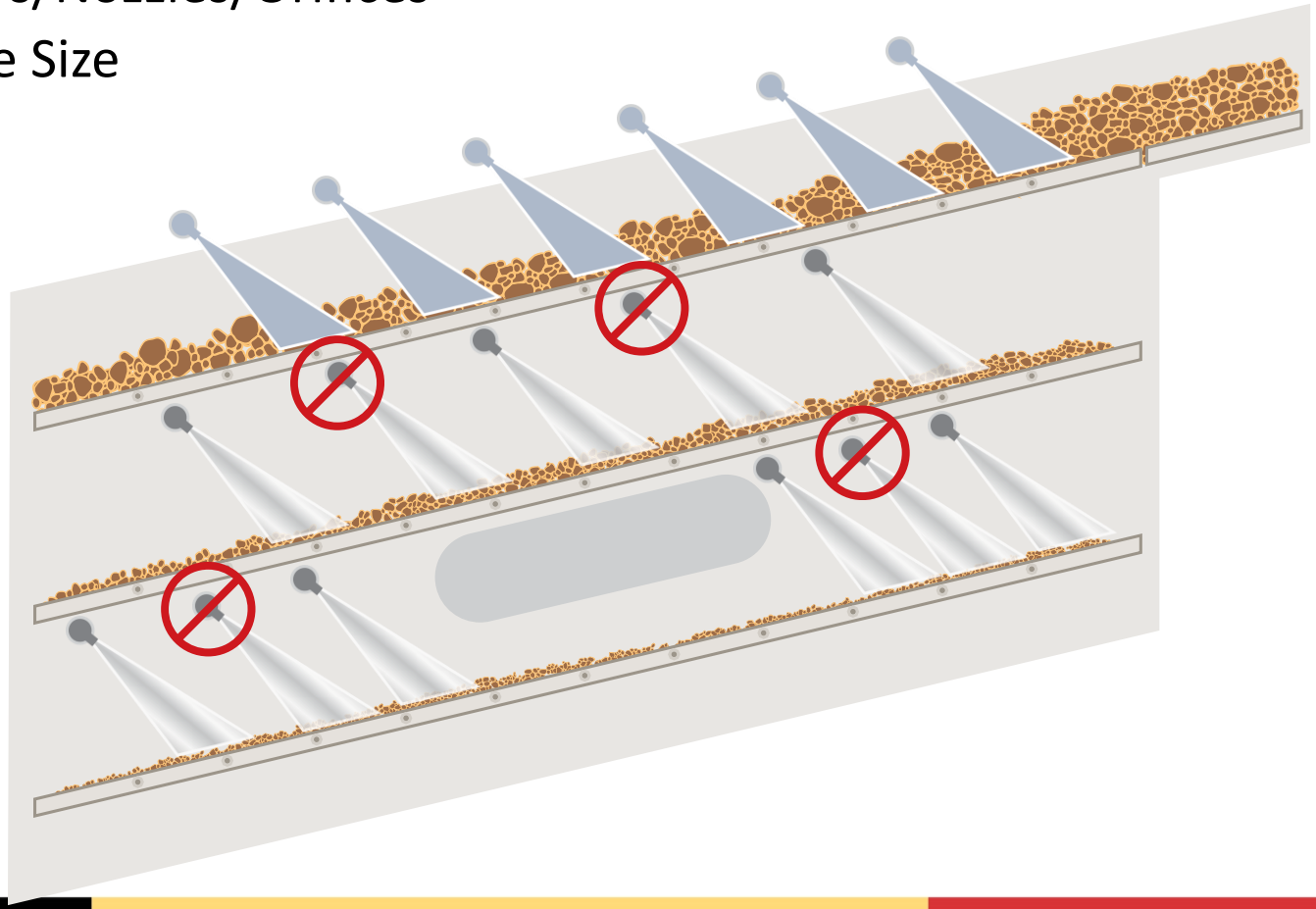
Spray Bar Location

- Gradation Dependent (Percent Fines)
- Bed Depth (4:1)
- Critical Decks



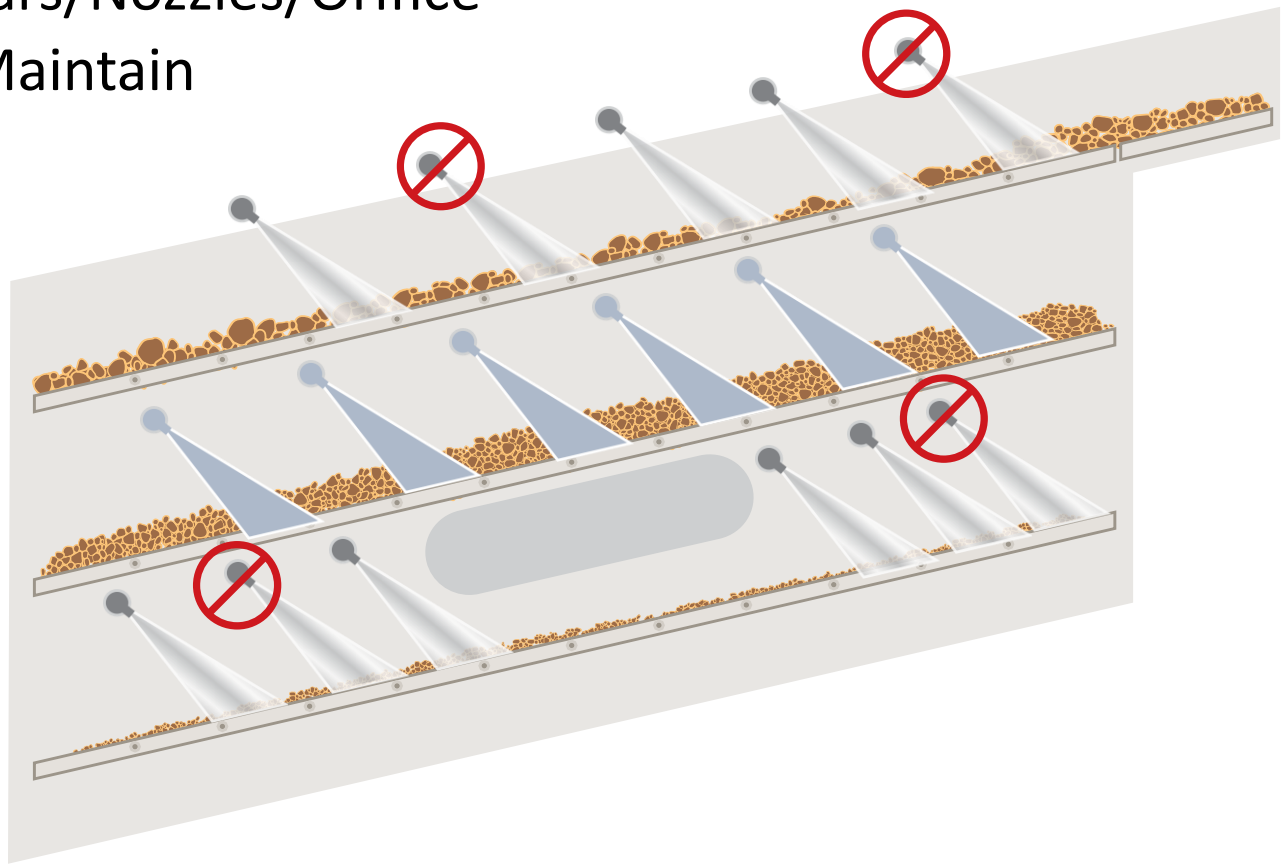
Critical Decks – Top Deck

- Focus Water/Pressure to Top Deck
- Adjust Valves
- Add Spray Bars/Nozzles/Orifices
- Larger Particle Size



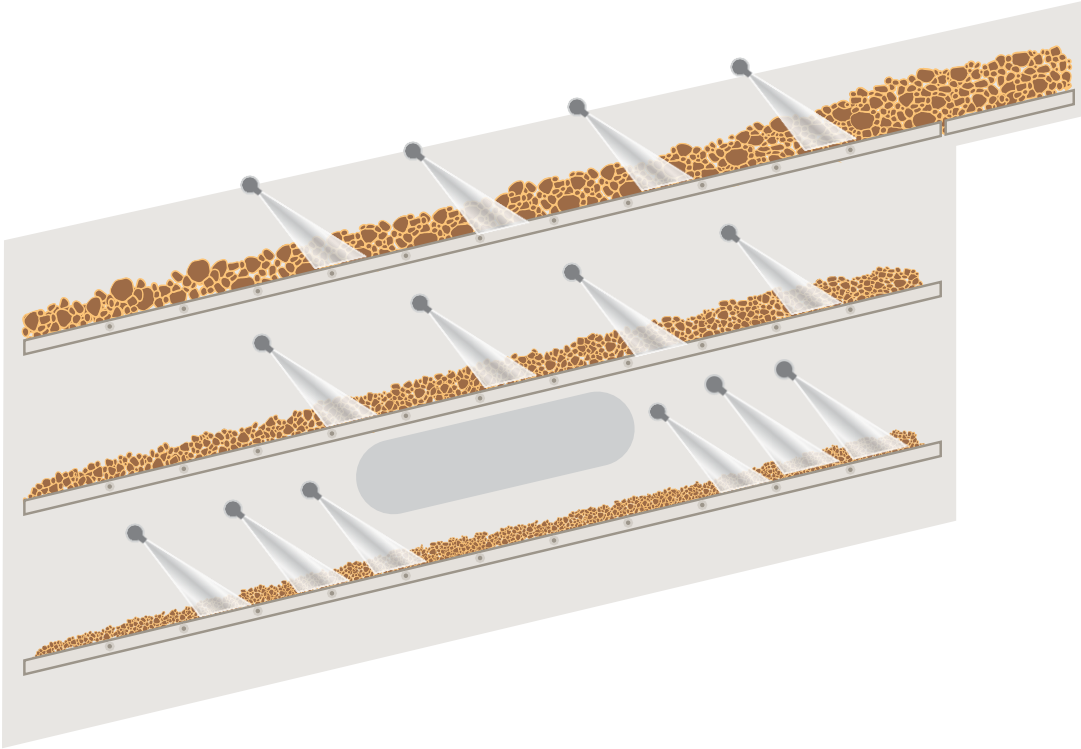
Critical Decks – Middle Deck

- Focus Water/Pressure to Middle Deck
- Adjust Valves
- Add Spray Bars/Nozzles/Orifice
- Difficult to Maintain

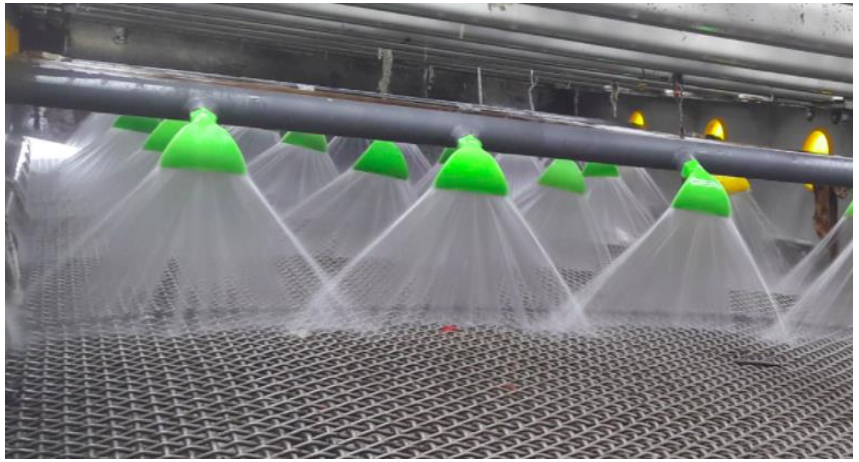


Critical Decks – Bottom Deck

- Commonly are the Critical Decks
- Highest Percentage of #4 Minus
- Smallest Particle Size
- Deepest relative Bed Depth (4:1)
- Mech Tube (Limited Spray Bars)
- Clays/Clay Balls
- Spray Bars Splitter

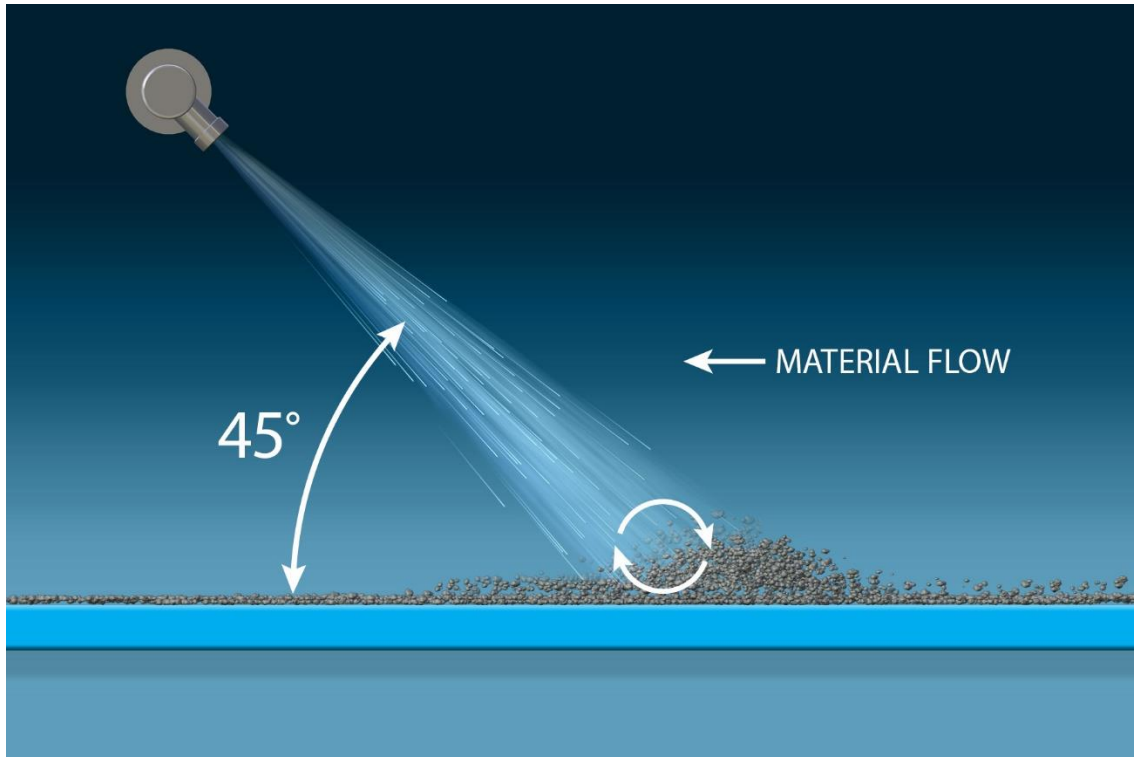


Spray Bar System - Nozzles



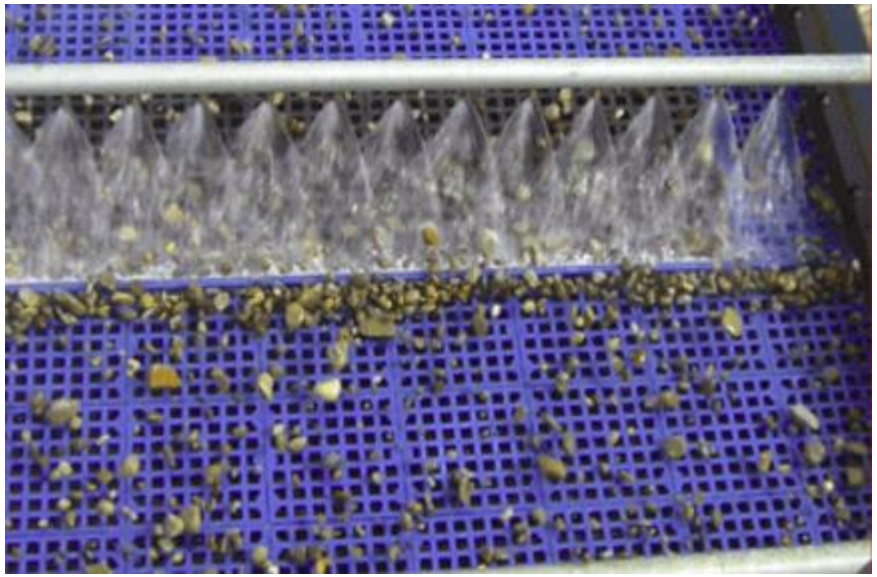
Spray Nozzle Orientation

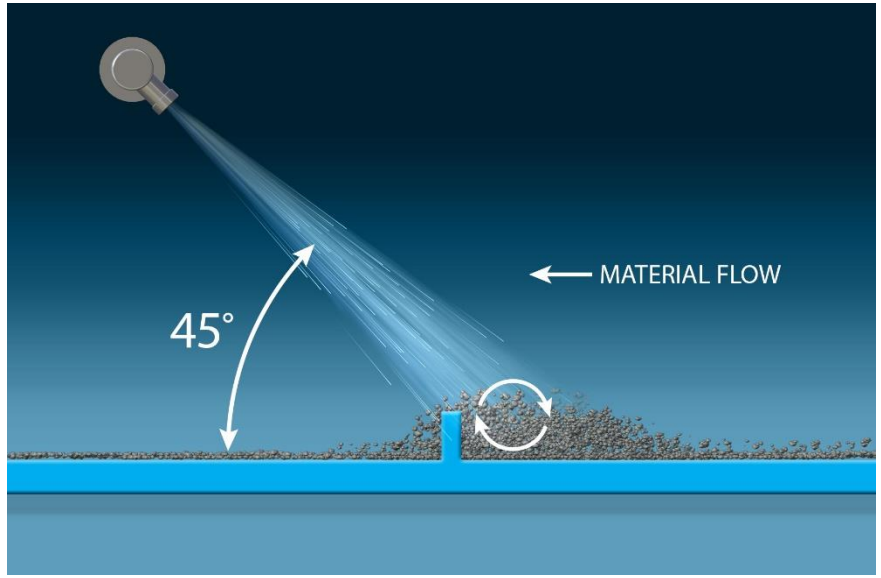
- 45 Degree Angle
- Towards Feed End
- Create Water Dam



Water Dams + Surface Dams

- Greater Retention Time of Material Under Water
- Increased Screen Efficiency
- Decks with Higher Fines Content
- Better Exposure of Fines/Near-Size to Water





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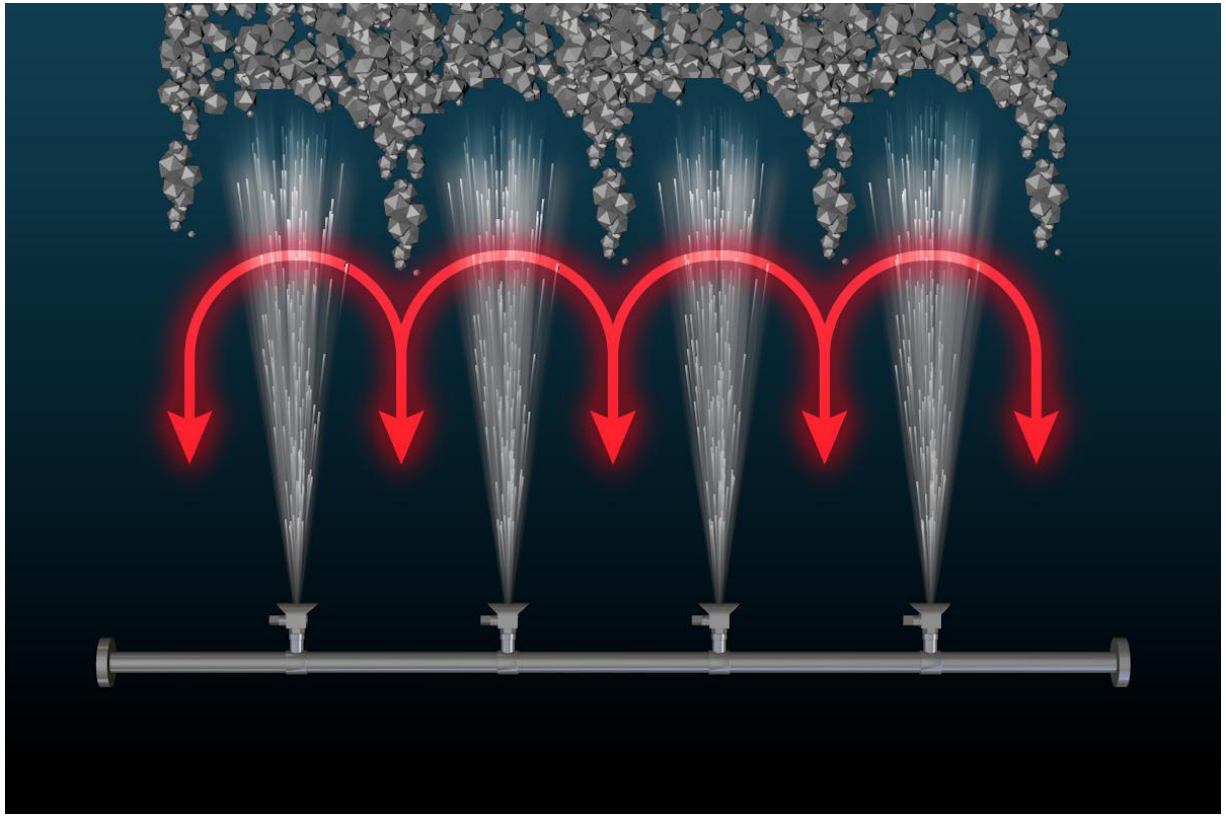
Spray Nozzles Spacing Gaps

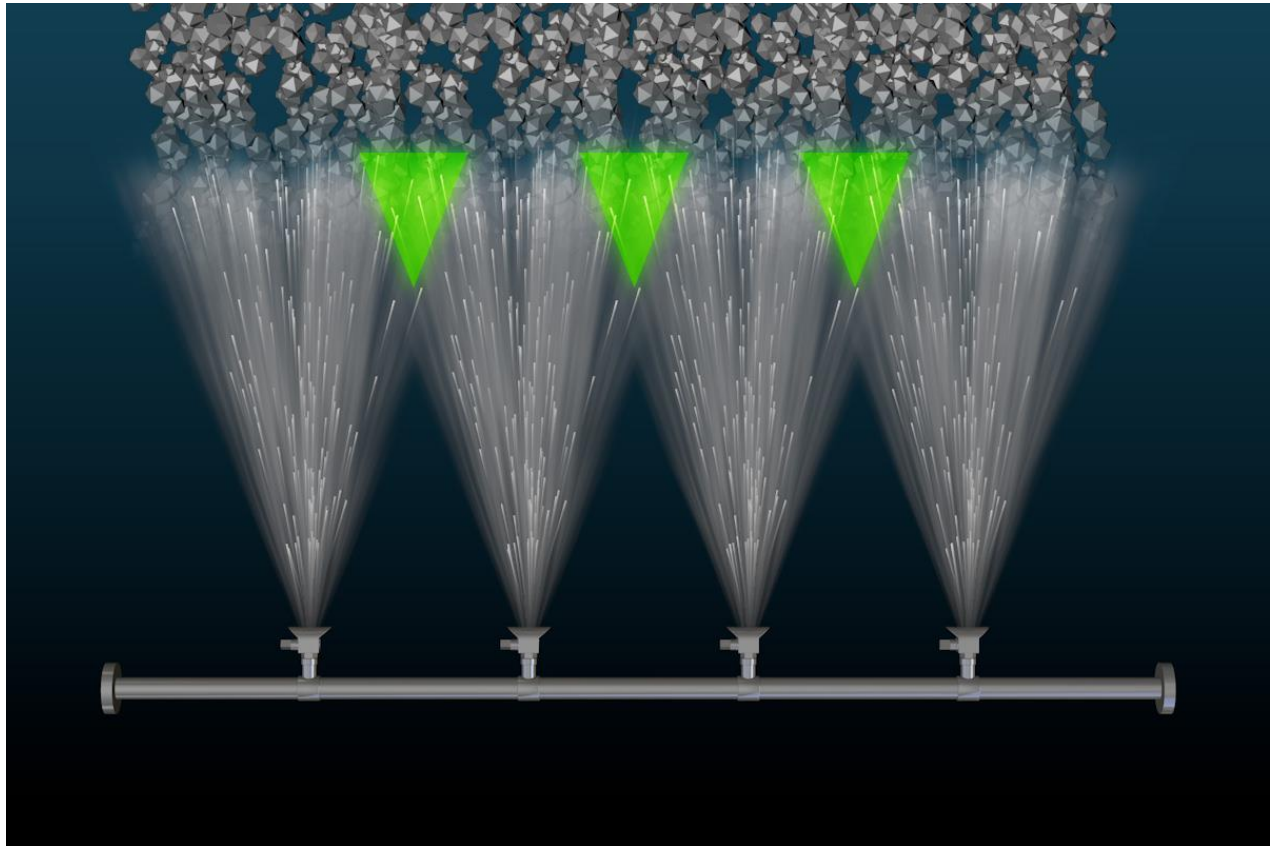
Spray Nozzles Spacing Gaps

Gaps in Spray Allows Material to Bypass Water



Spray Nozzles – Spacing

Spray Should Overlap 25% on Each Side



Plugged Spray Nozzles Gaps

- #2 Most Common Issue with Wet Screens (#1 Low Pressure)
- Select Nozzles that are Easier to Clean
- Cleaning/Blow-Out Valves
- Inspecting/Cleaning Schedule
- Pump Strainers

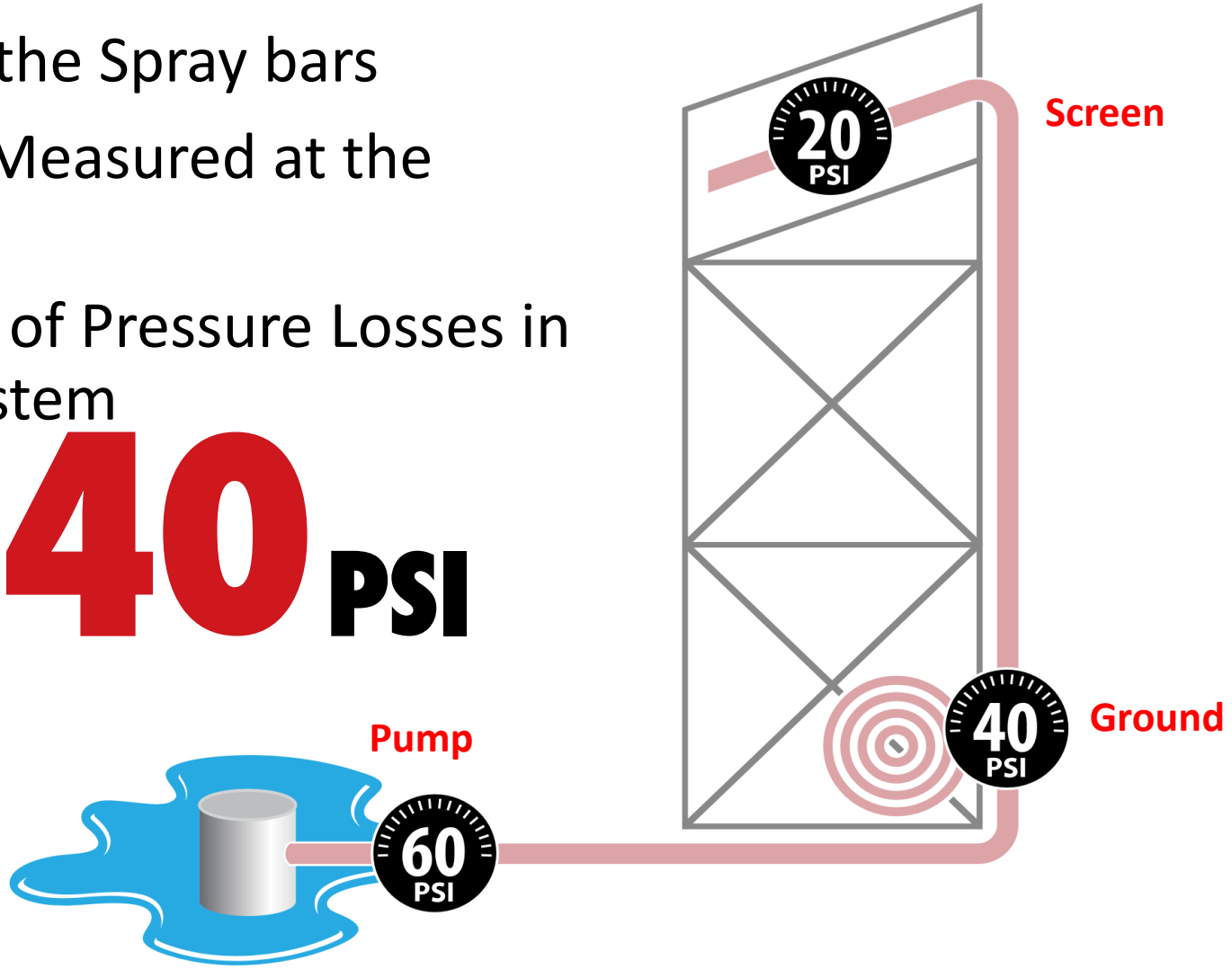
Water Pressure - Why

- Need Adequate Pressure to Penetrate Bed Depth (4:1)
- Higher Pressure Removes Fines More Efficiently
- Silts and Clays Adhere to Material Stronger
- Break up Lumps and Clay Balls
- Create “Water Dams”

Water Pressure - Where

- 40 PSI at the Spray bars
- Must be Measured at the Screen
- Be aware of Pressure Losses in Water System

40 PSI



Water Pressure - Consistent

- 40 PSI of Consistent Pressure
- Be Aware of Intermittent Pressure Drops
- Clean-up Hoses
- 

40 PSI

Pressure-Capacity

Pressure PSI	CAPACITY IN GPM											
	DIAMETER OF ORIFICE											
	5/32"	3/16"	7/32"	1/4"	9/32"	5/16"	11/32"	3/8"	13/32"	7/16"	15/32"	1/2"
20	2.1	3.0	4.0	5.2	6.6	8.1	9.8	11.7	13.7	15.8	18.2	20.1
30	2.5	3.6	4.8	6.4	8.1	10.0	12.0	14.4	16.8	19.5	22.4	25.4
40	2.9	4.1	5.7	7.4	9.3	11.5	13.9	16.5	19.4	22.4	25.8	29.4
50	3.2	4.6	6.3	8.2	10.4	12.8	15.5	18.5	21.6	25.0	28.8	32.9
60	3.5	5.1	6.9	9.0	11.8	14.0	17.0	20.2	23.8	27.5	31.6	36.0
70	3.8	5.6	7.5	9.7	12.3	15.1	18.3	21.8	25.6	29.6	34.0	38.8
80	4.1	5.9	8.0	10.3	13.1	16.2	19.5	23.3	27.3	31.6	36.3	41.4
90	4.3	6.2	8.5	11.0	14.0	17.2	20.8	24.8	29.0	33.6	38.7	44.0
100	4.6	6.6	8.9	11.6	14.7	18.1	21.9	26.1	30.6	35.4	40.7	46.4

Factors Effecting Wet Screening

- Bed Depth
- Particle Size - Near Sized Material
- Clays and Silts - Deleterious Material Content

Bed Depth

- 4:1 Ratio of Bed Depth to Aperture Size (Discharge End)
- 1” Opening = 4” Bed Depth
- 3/16” Opening = 3/4” Bed Depth
- Deeper Bed Depths Require more Water and Pressure
- Harder for the Water to Penetrate
- Screening Standard: 25% Oversize and 40% Half Size

Particle Size – Near Size

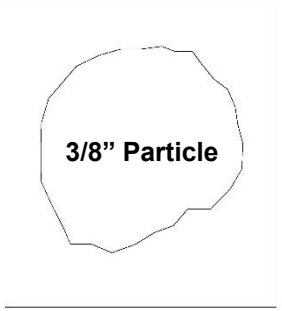
- **Particle Size**
  - The closer the particle size to the aperture, the harder to pass it.
  - “Half Size” and smaller go fairly easily.
    - ¼” particle, ½” aperture, e.g.
  - “Near Size” takes a lot more time.

Probability of Passage

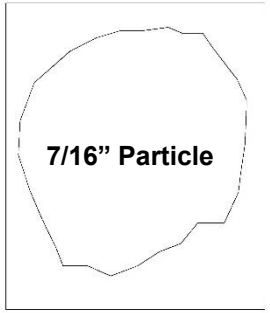
Ratio of Particle Size to Aperture Size	Chance of Unrestricted Passage per 1000	Number of Apertures Required in Path
0.001	998	1
0.01	980	2
0.1	810	2
0.2	640	2
0.3	490	2
0.4	360	3
0.5	250	4
0.6	140	7
0.7	82	12
0.8	40	25
0.9	9.8	100
0.95	2	500
0.99	0.1	10000
0.999	0.001	1000000

*Reproduced from 'Mineral Processing Technology', B.A Wills, 4th Edition

3/8” / 1/2” = 0.75



7/16” / 1/2” = 0.875

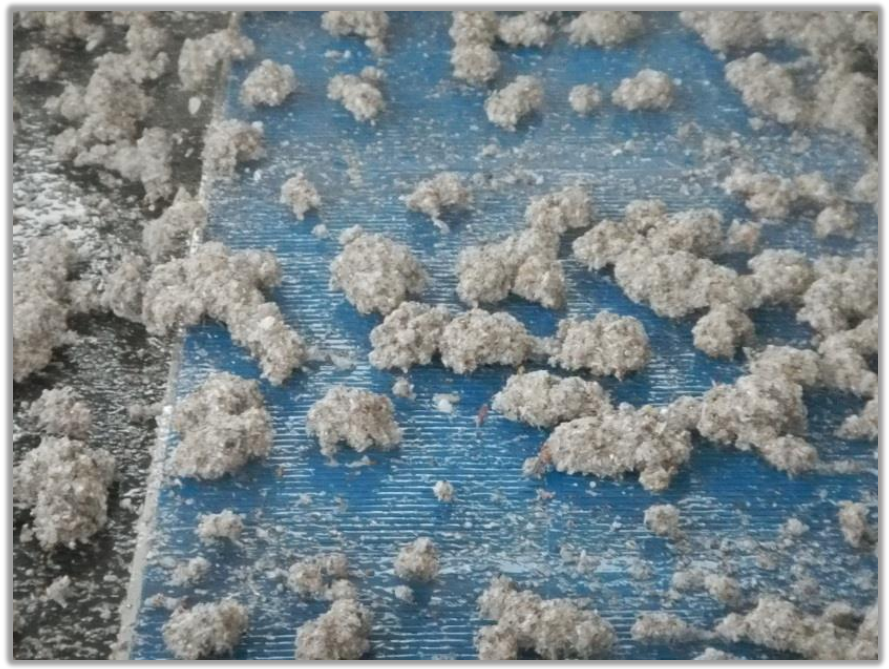


Particle Size

- Smaller Material has Greater Surface Area
- Larger Material has bigger Voids
- Bottom Decks Are Most Challenging

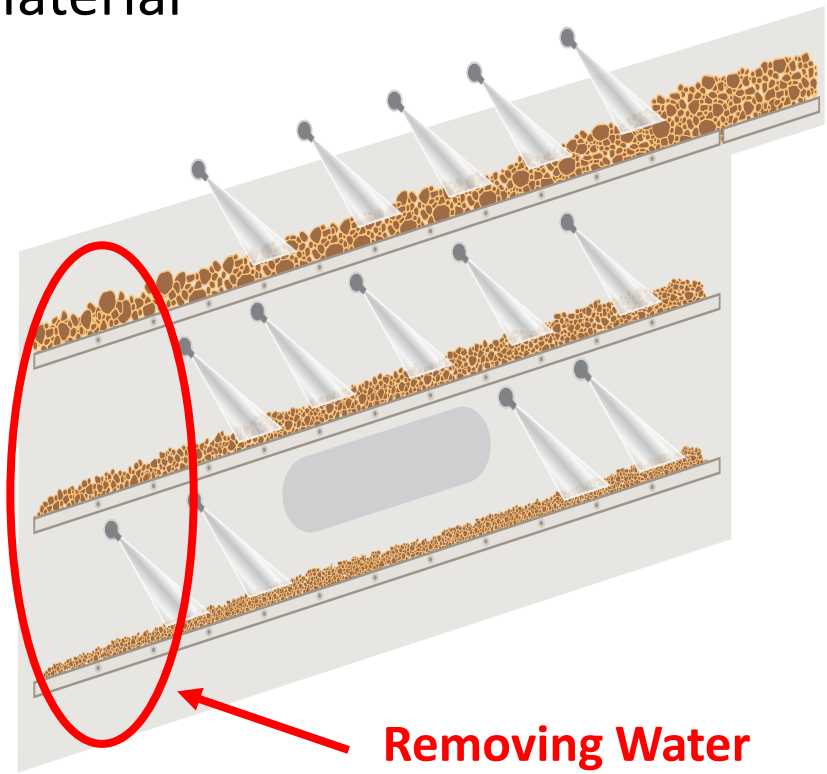
Clays and Silts

- Clays and Silts Adhere to Material Stronger than Rock Dust
- Inherent Moisture
- Clump and Stick Together
- Clay Balls - Must be Broken up



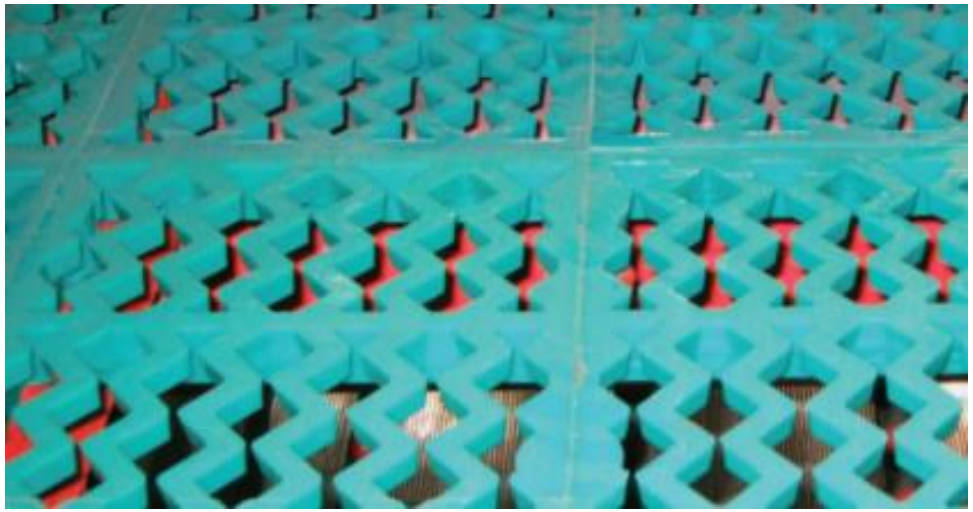
Decanting Water

- Removing Excess Water From Material
- Discharge End of Decks
- Surface Dams
- Panel Selection



Decanting Water – Panel Selection

- VR “Zig-Zag” Panels Decant Water Better
- Anti-Plugging
- Slotted Apertures
- Discharge End of Decks



Wet Screen Summary

- 5 GPM Water per STPH Feed to the Screen
- 40 PSI Water Pressure at the Screen
- 1/3 of Water Going to the Head Box
- Spray Nozzles at 45 Degree Angle Towards Feed End
- Water Dams Increase Washing/Rinsing Efficiency
- Know Your Gradation/Critical Decks

Thank You for Your Time!

Illinois Association of Aggregate Producers
IAAP
Building Illinois' Future

MAB EQUIPMENT COMPANY, INC.

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