Well Inspection and Repair

ATCAVE – CT Section AWWA

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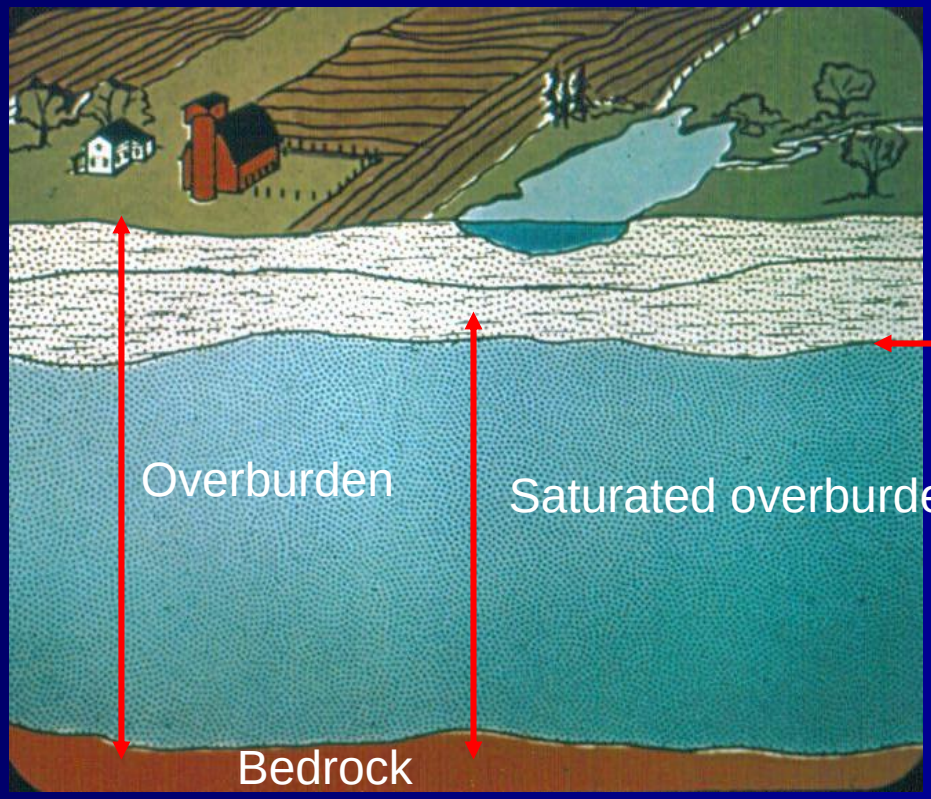
There is more than 100 times as much fresh water in the ground as there is in all of our rivers and lakes

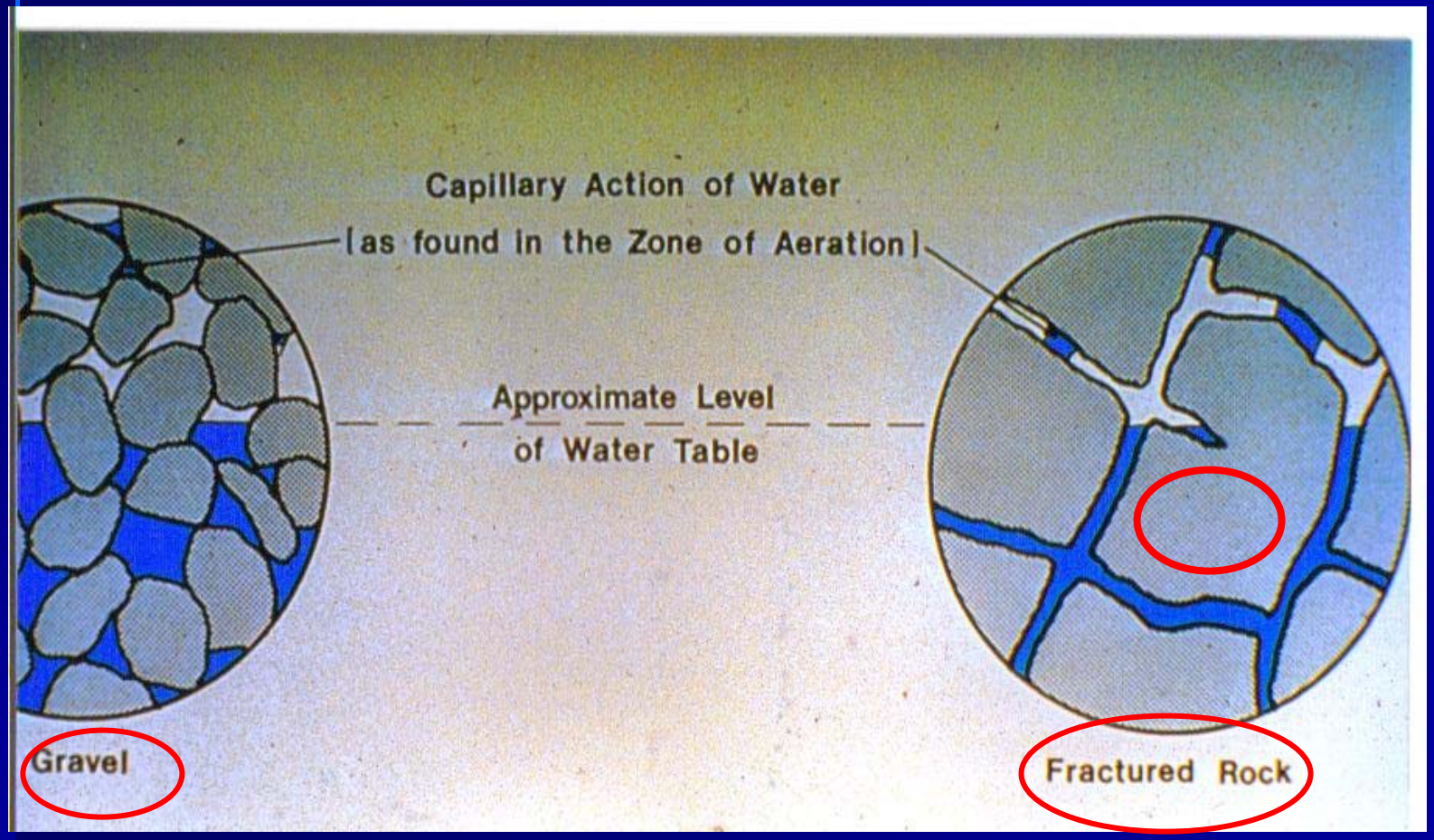
Basic ground water concepts



Water table (Static water level)

- In overburden, the water is in the pore spaces

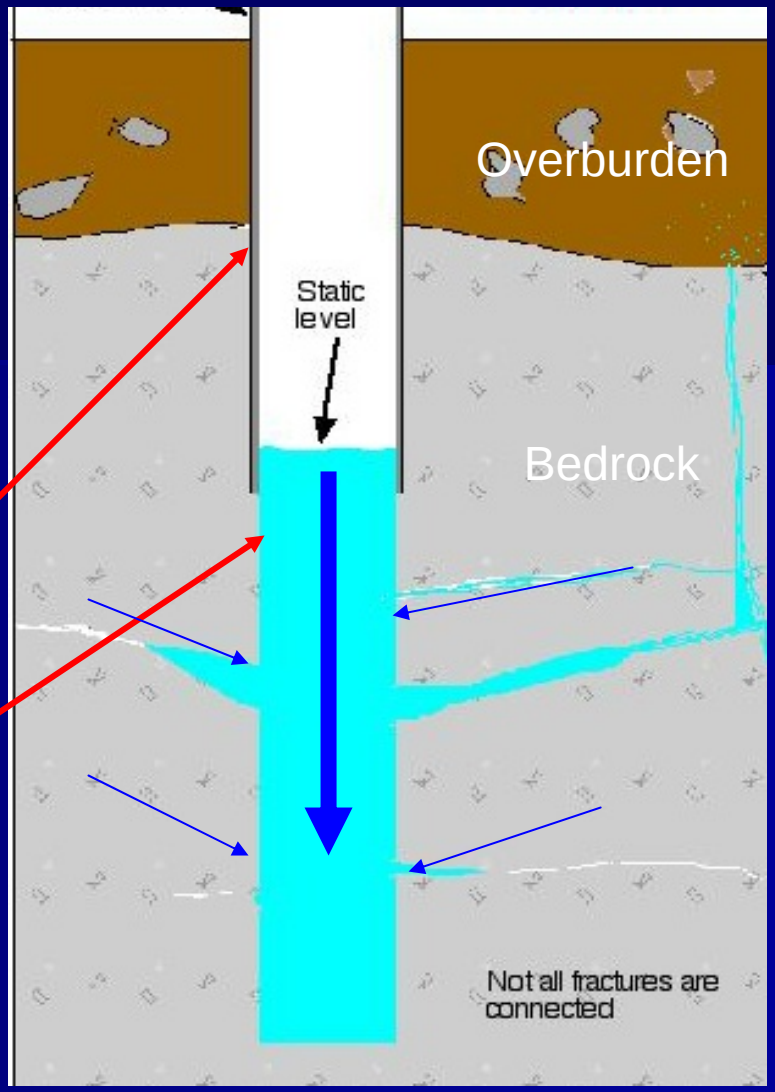
- In most rock, there is more water in the fractures than in the pore spaces



- Bedrock Well
- Typical homeowner well, but often used for public supply also
- Casing from surface into the bedrock

Open hole in rock below the casing

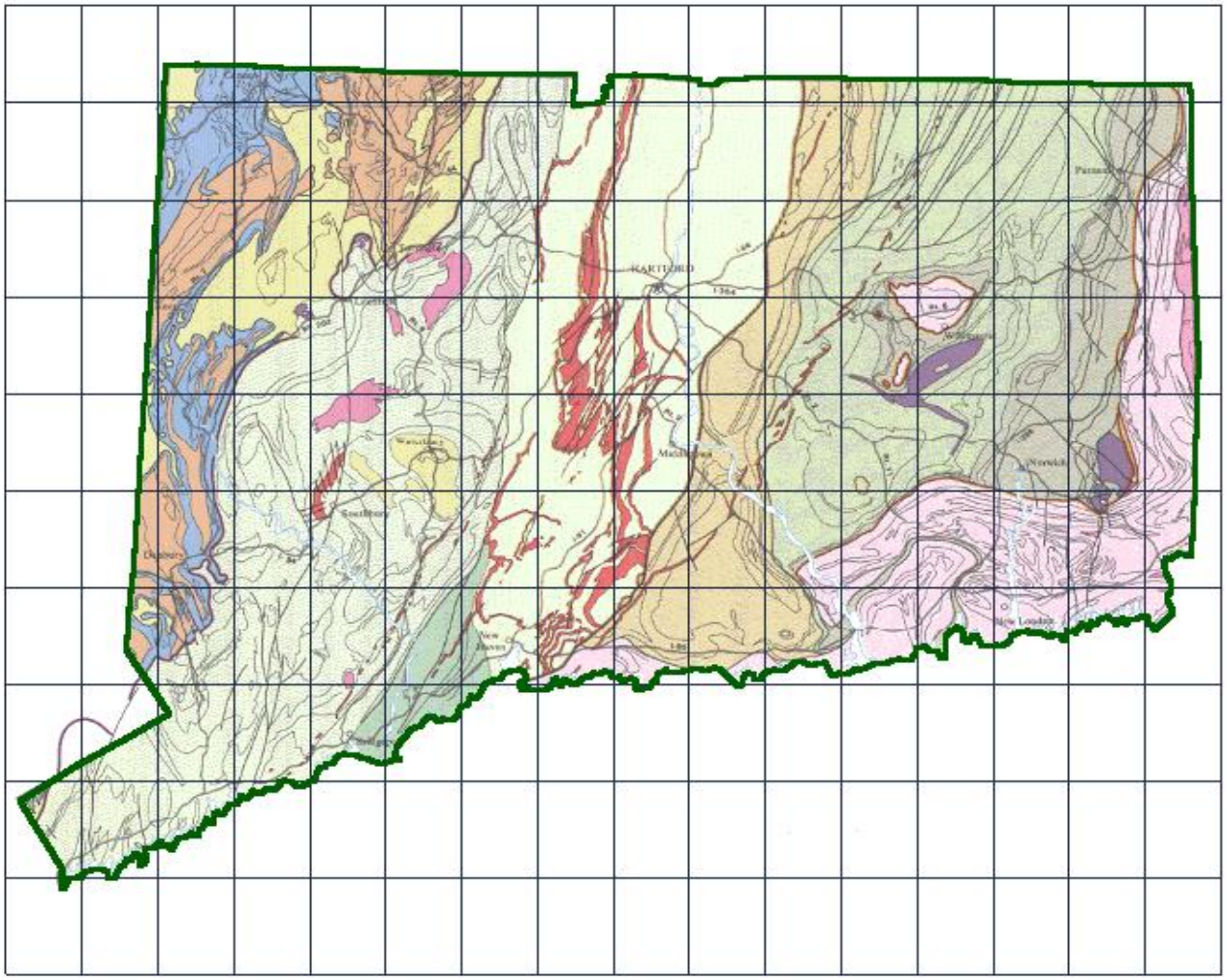
Depth can be several hundred feet



Fractures

Where is this water in the summer?

Wide variety of bedrock in CT

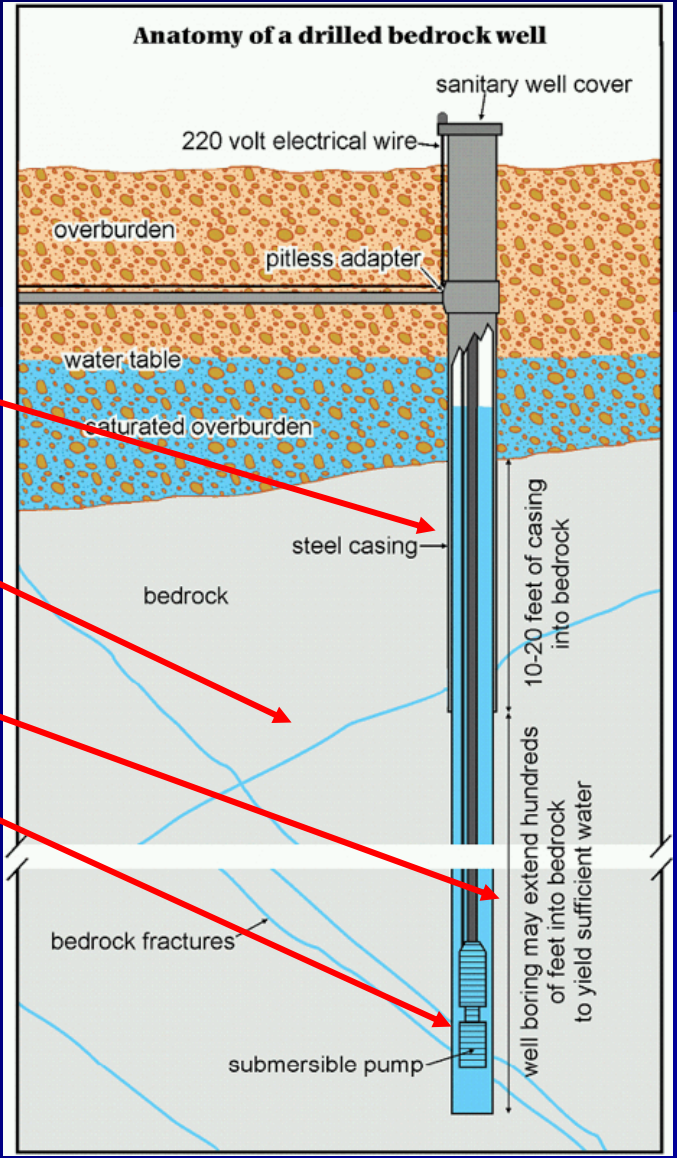


Bedding plane orientation

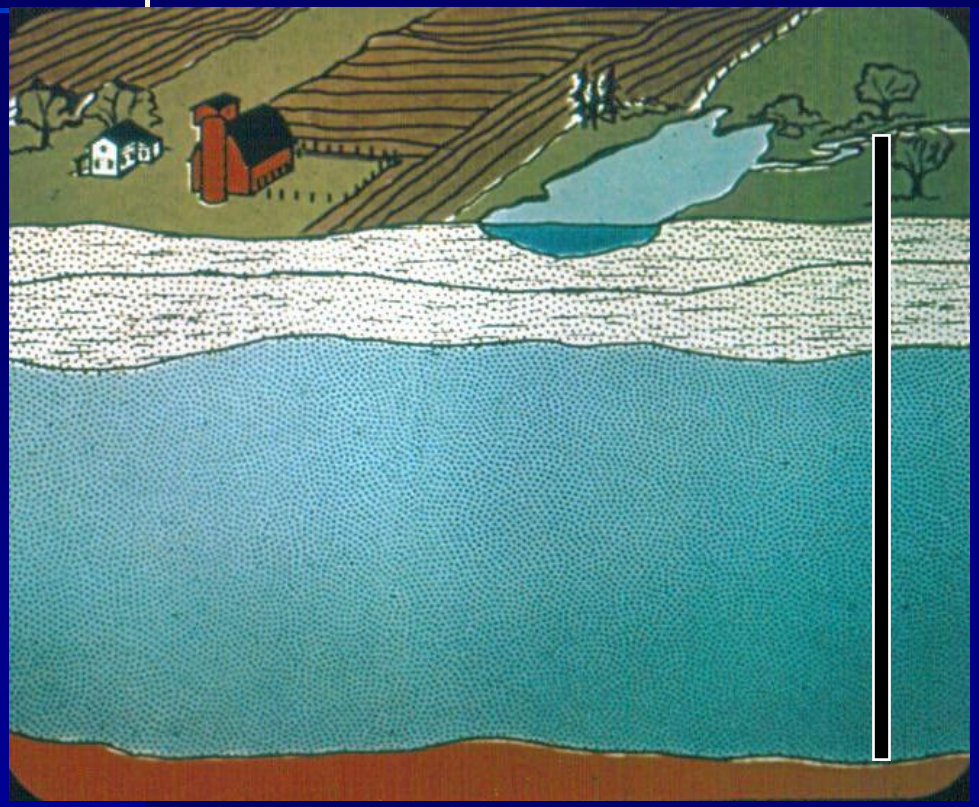
Yield of rock well will be affected by…

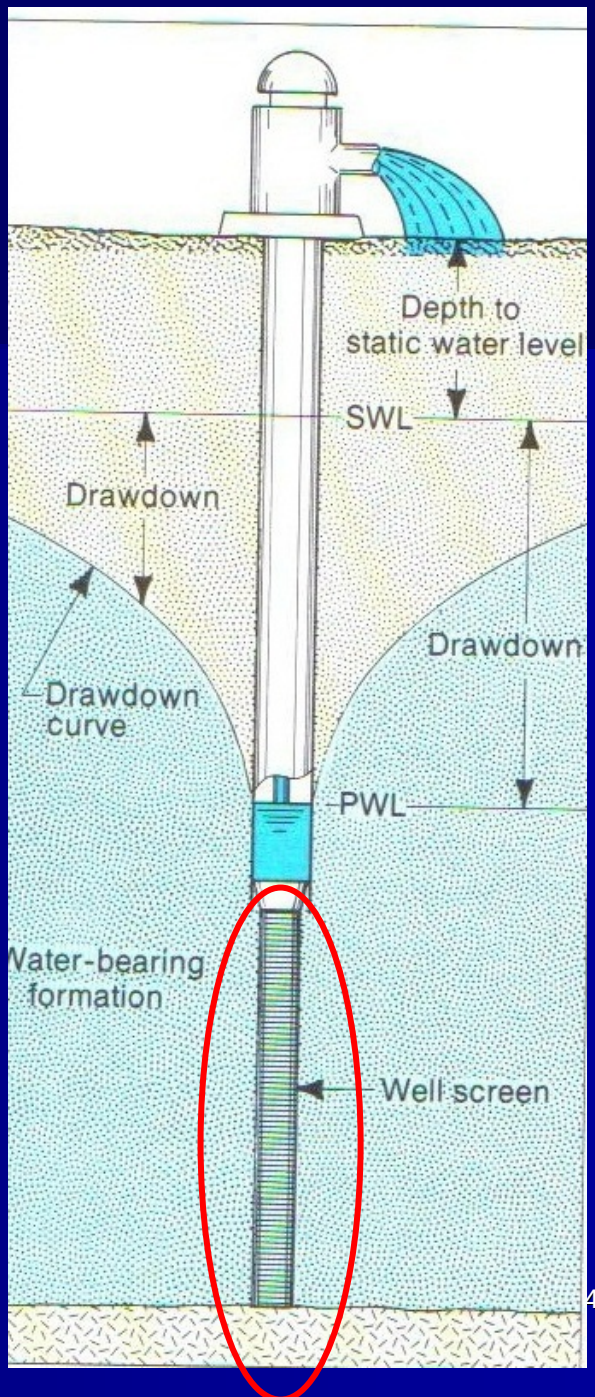
- Type of rock
- Direction of bedding
- Orientation of fractures
- Number of fractures and how they are connected
- Depth of well and depth to static level
- Water quality

- We will see problems in bedrock wells with --
- Casing integrity
- Seal at bottom of casing
- Unstable rock
- Sand in rock well

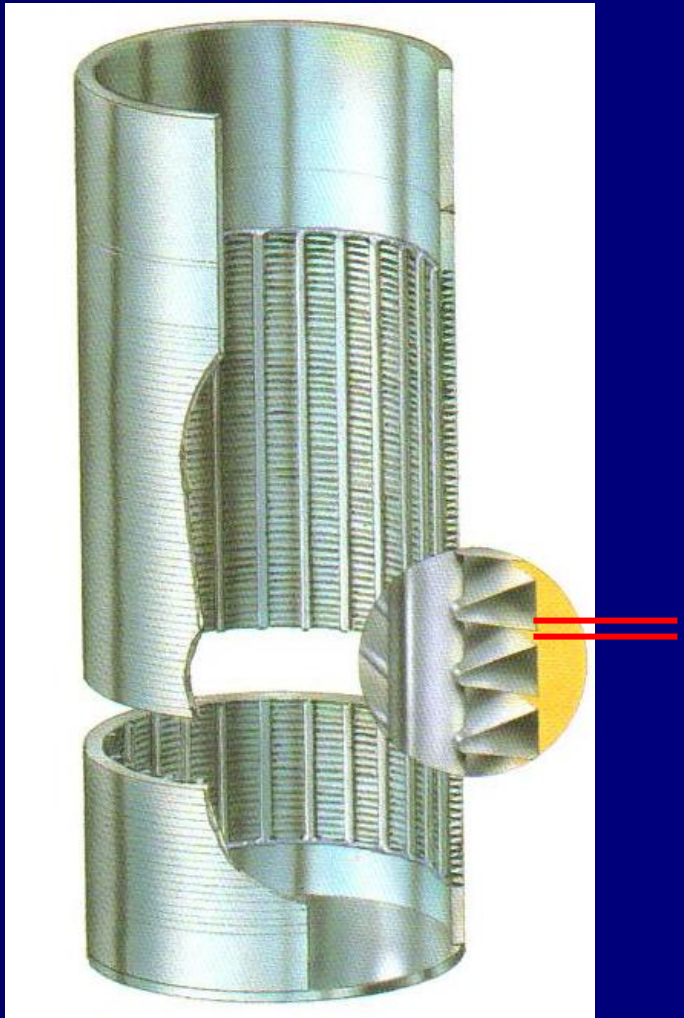


Wells in the Overburden (Screened wells, gravel wells)

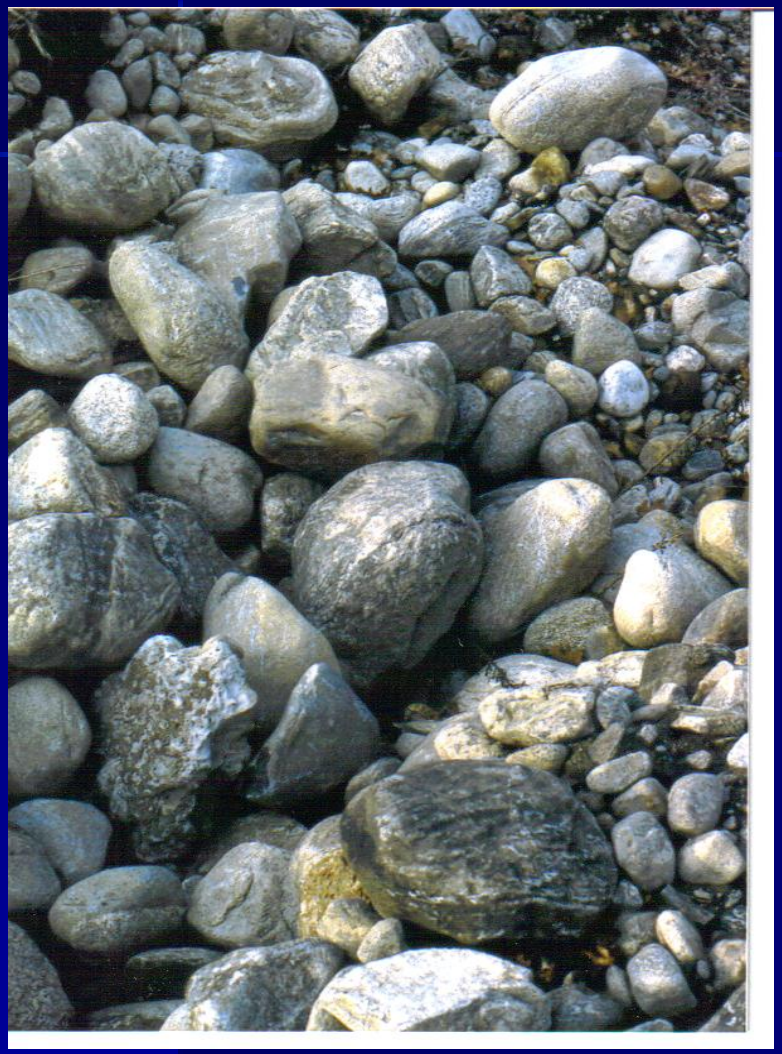




Well screen considerations--

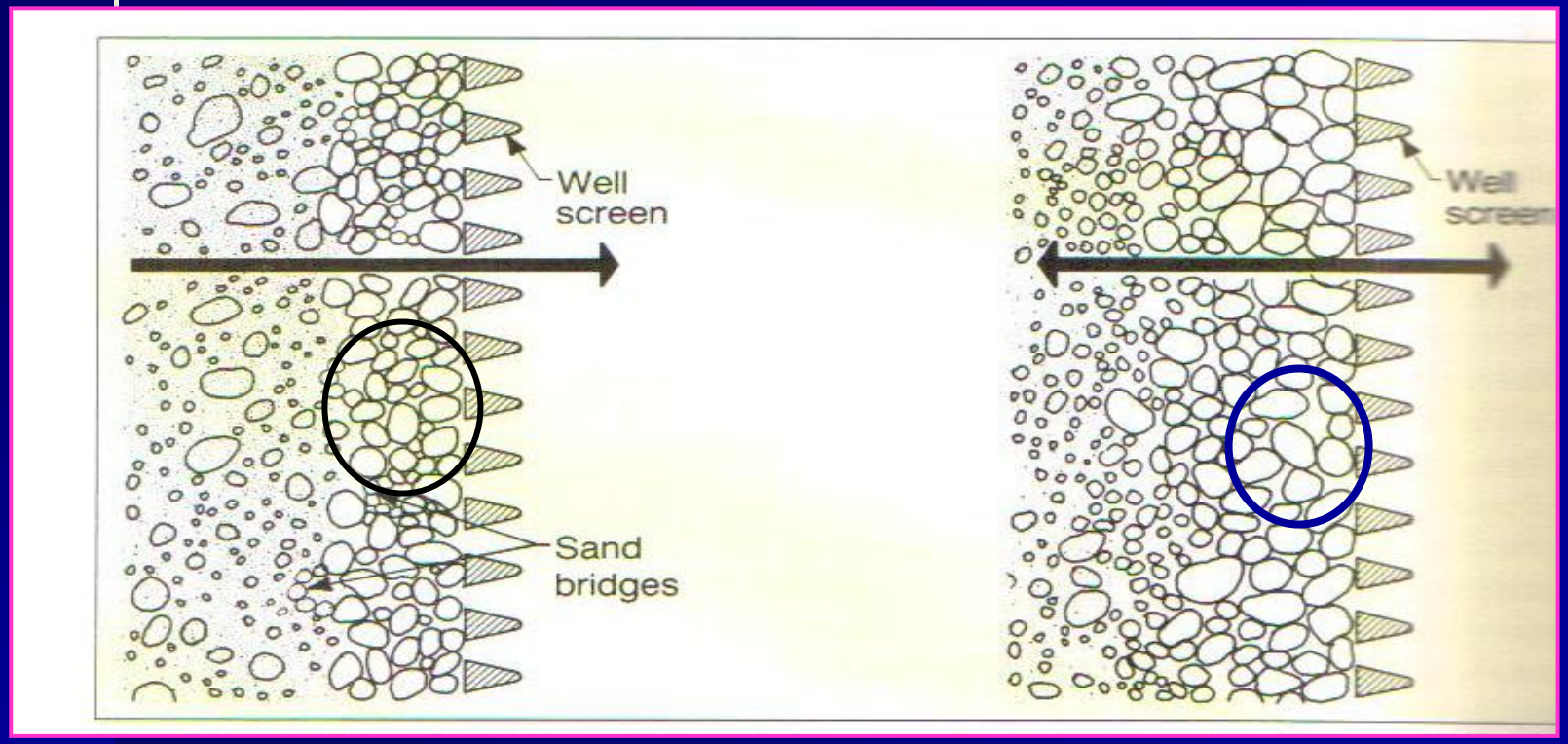


- The openings in the screen are called the Slot Sizes
- Larger slot size will allow in higher flow rate
- Larger slot size will allow in more sand/ gravel –
- We typically screen up to 1/3 of the saturated thickness of the aquifer
- Most gravel wells in CT are less than 100 ft deep



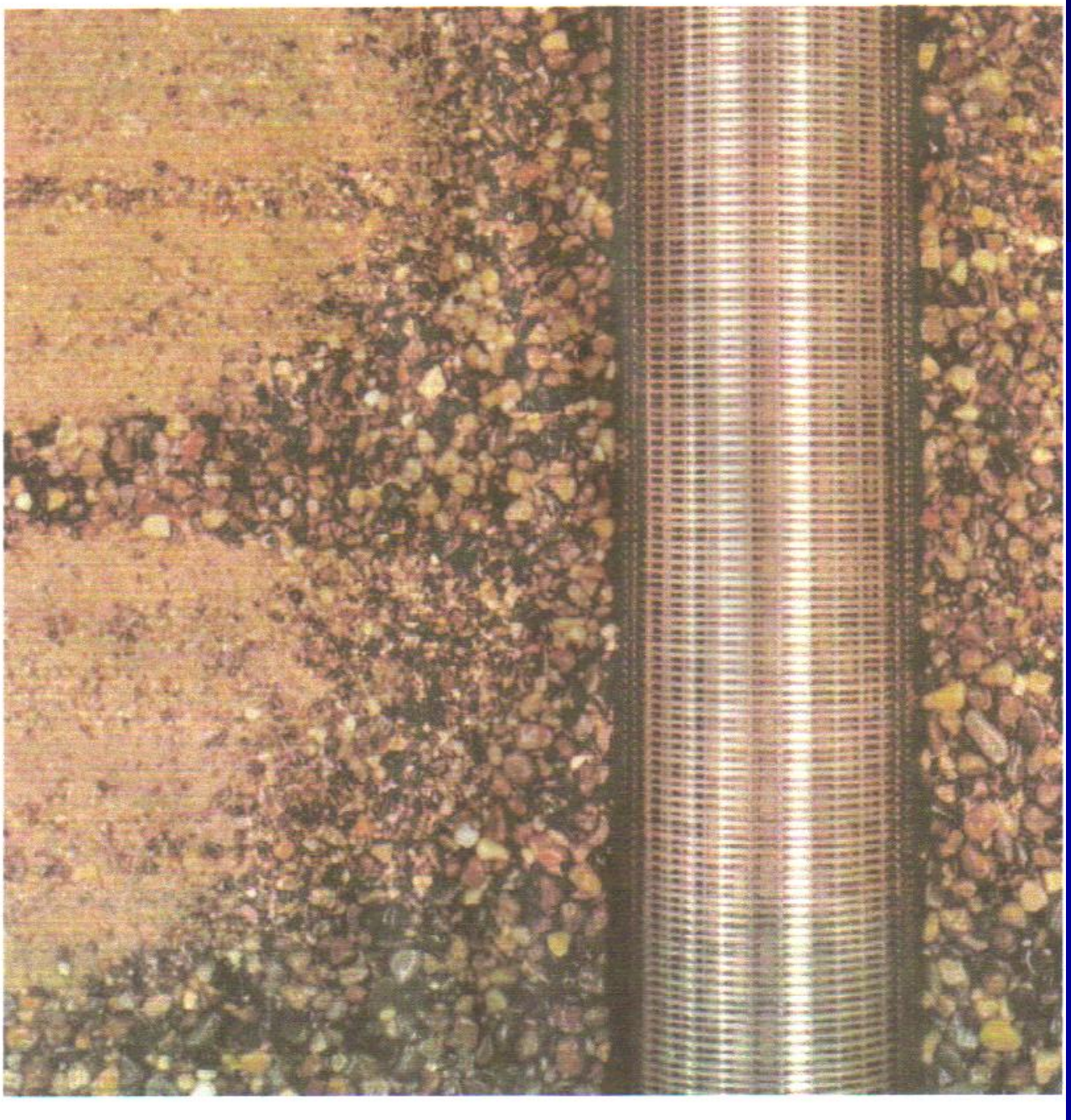
Well with 15 feet of screen in this material pumped 1180 gpm with about 20 feet of drawdown

Screen selection and development – the heart of the well

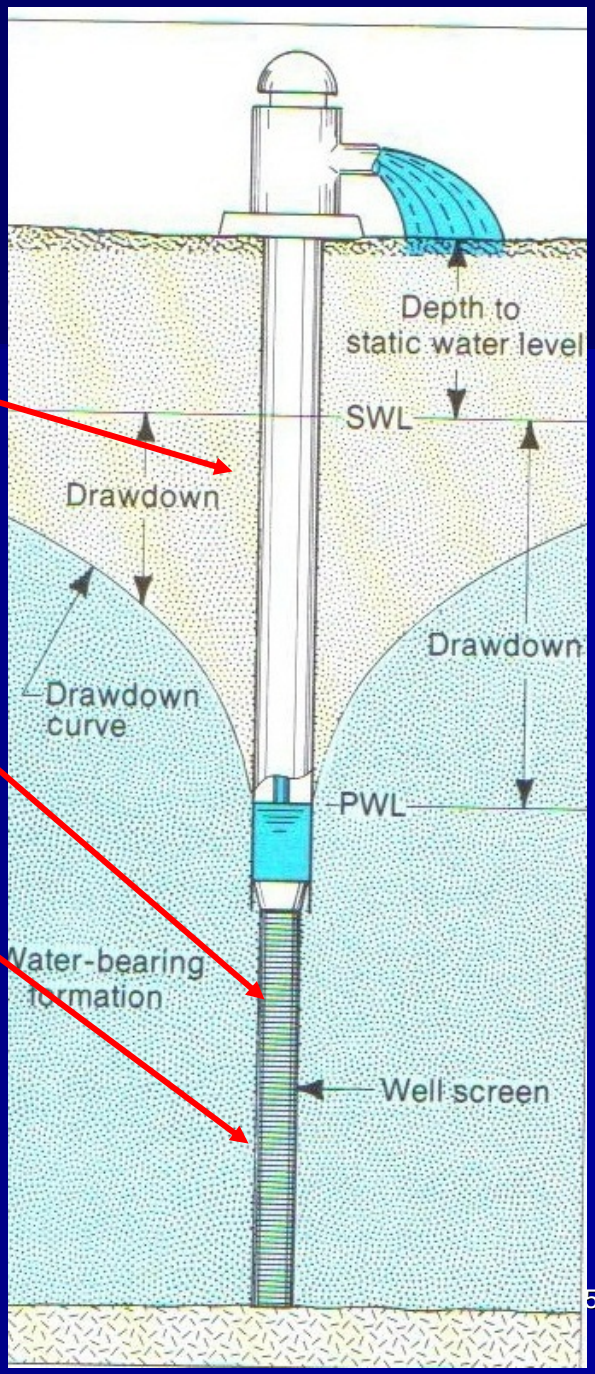


Before development

After development



- Potential problems with screened wells
- Casing integrity
- Screen integrity
- Screen plugging

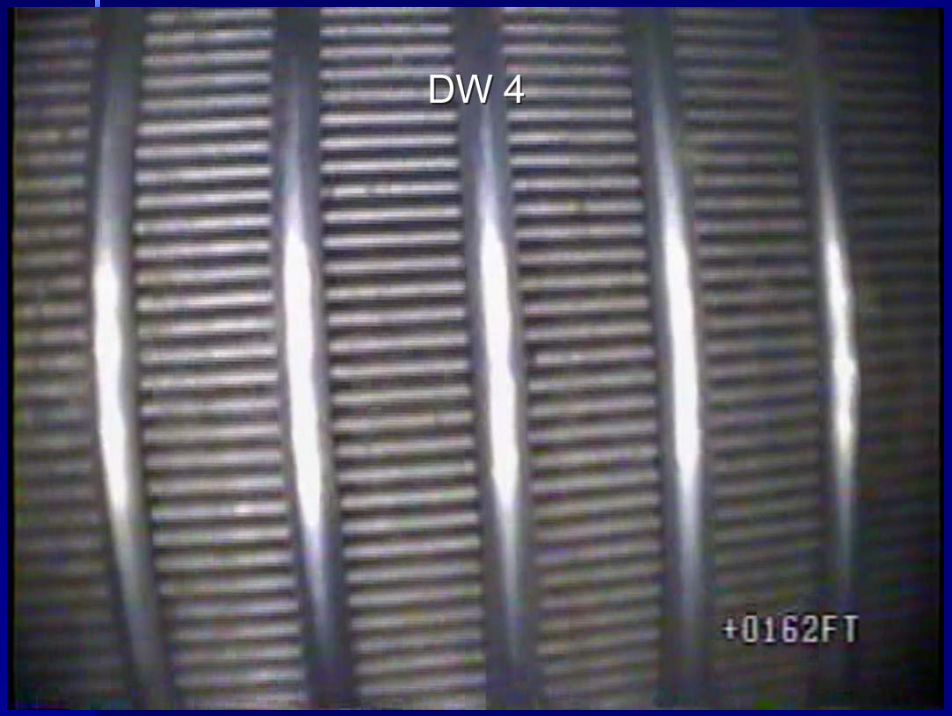


Underwater camera

- Camera head tilts so we can look down the well, at the side, or back up the well
- Camera head rotates a full 360 degrees

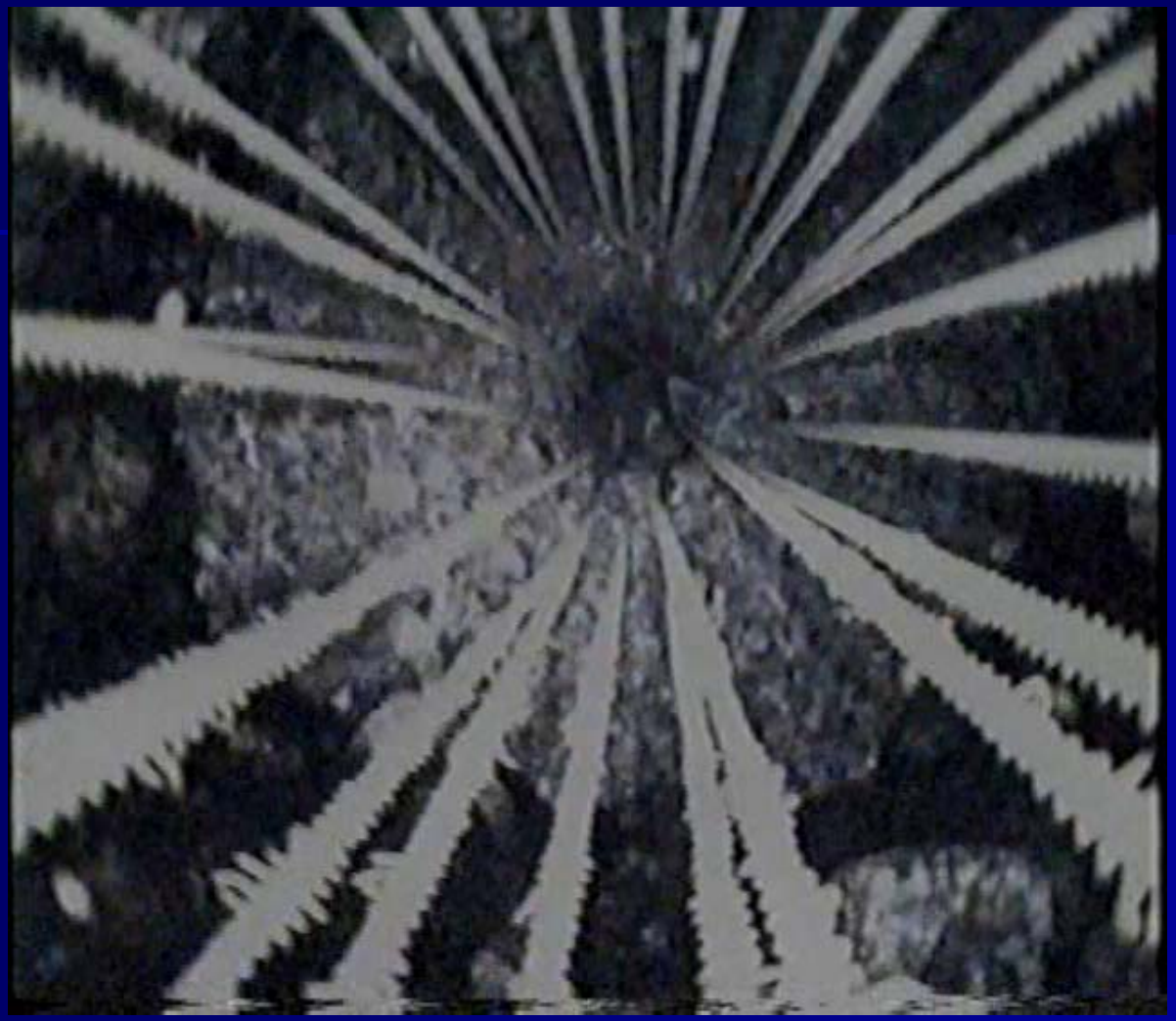
Recording TV
Camera in well
Power Winch

Well screens -



The horizontal wires and vertical rods of a screen should be continuous, and parallel/ perpendicular to each other

Brass screen from very old well – Screen has eroded away but the most of the gravel is still in place



Looking down the well – Almost all of the horizontal wires are eroded away, most of the sand and gravel is gone

Rock well – The casing should be sealed into bedrock but it t was not drilled deep enough.

Surprise! Brick at 350 feet

Case History - bacteria in rock well

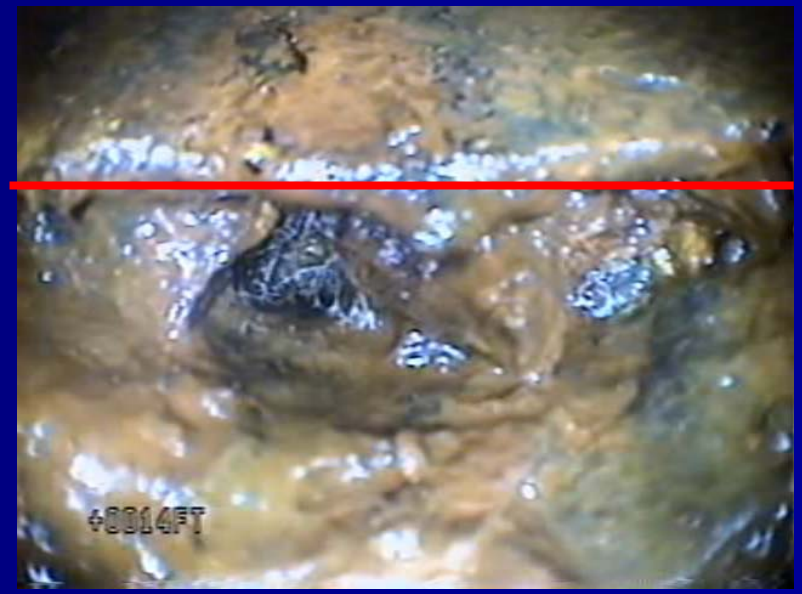
- Well depth 600 ft
- Casing depth – 13 ft
- Static water level – 100 feet

Pitless adapter

Seal between pitless adapter and casing was not watertight

Casing integrity is suspect – may be a hole

Poor seal between casing and rock



If the static water level is at 100 feet, why is it wet at 13 feet?

To repair this well…

- Set up over well with rig
- Chlorinate the well
- Pull out old casing
- Redrill the top 60 or 70 feet
- Set in new casing
- Grout casing in place
- Chlorinate the well

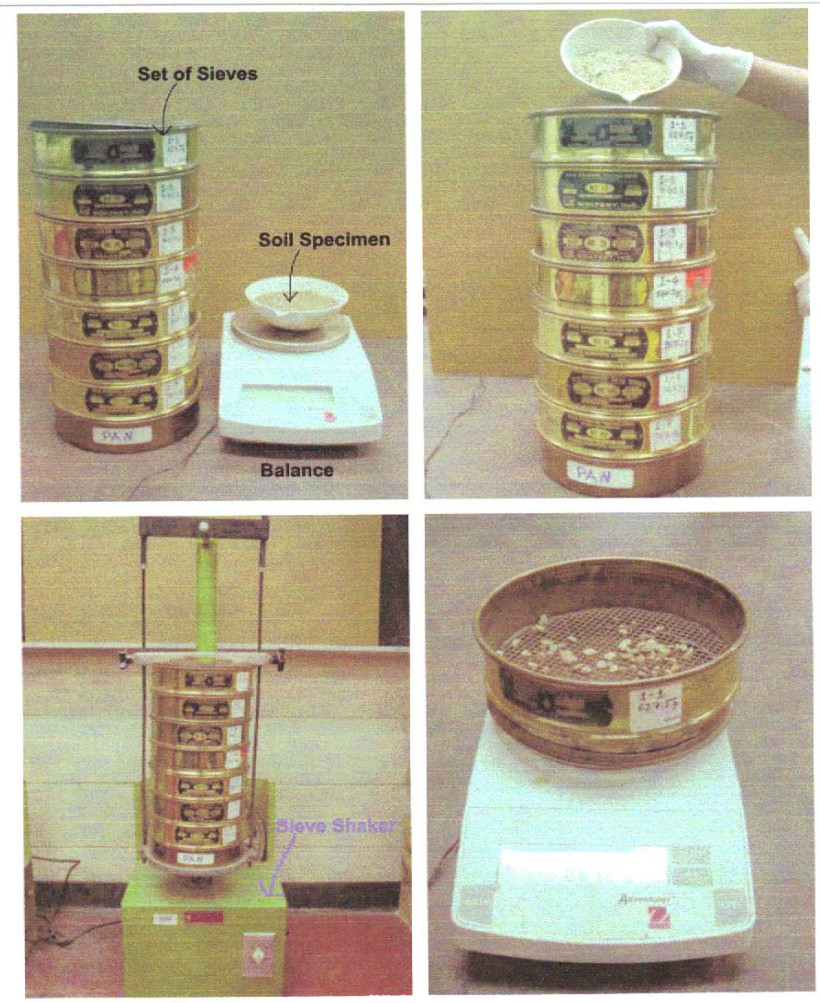
Case History : Structural problem in gravel well

- 400 gpm well
- 12 inch diameter, 63 feet deep
- .050 inch slot size screen, 10 feet long
- Well is 28 years old
- Sample taken with air lift off the bottom of the well had a lot of gravel in it
- Did a sieve analysis of the sample

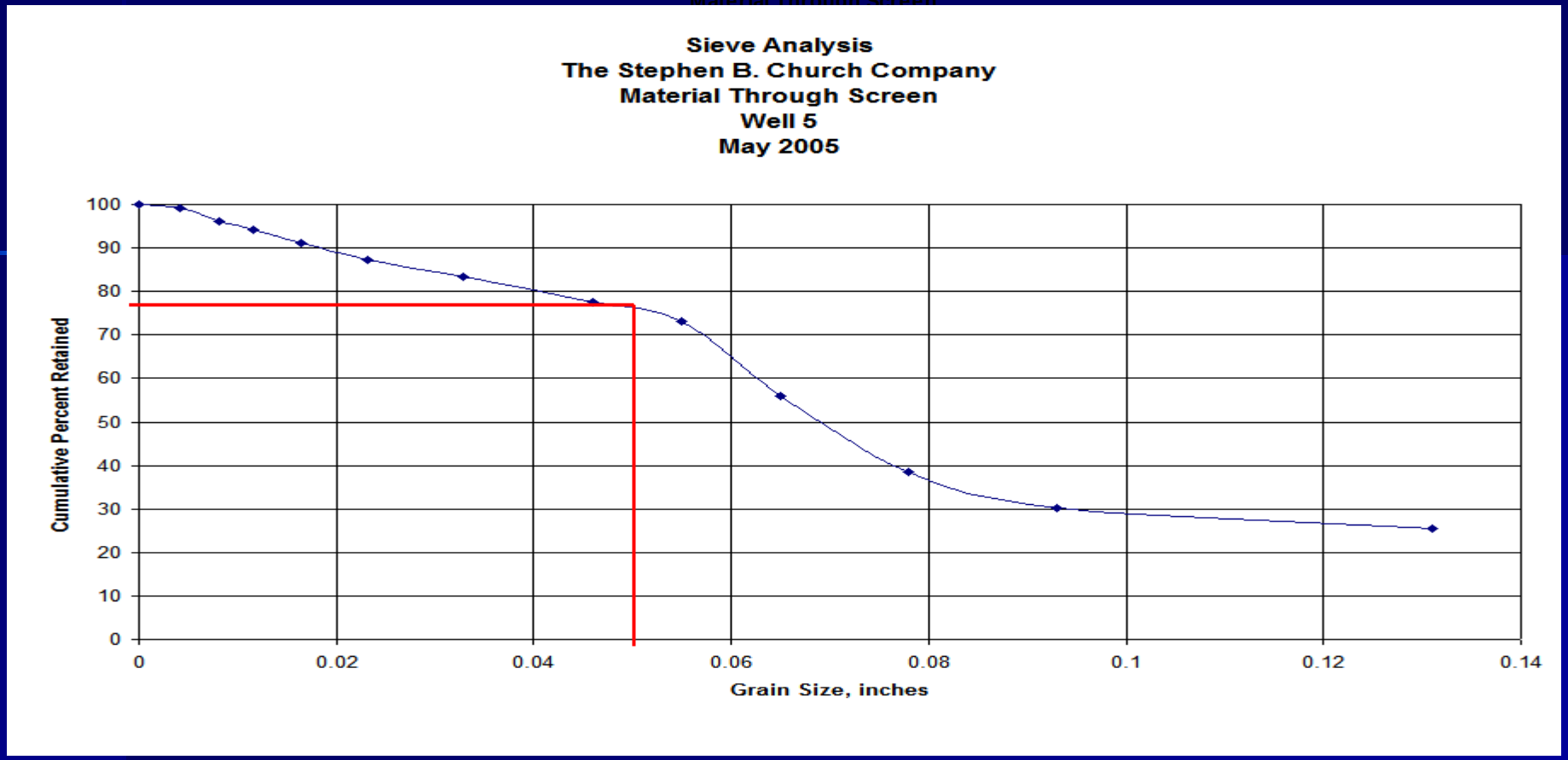
Sieve analysis

(gradation,

Grain size)



Sieve Analysis
The Stephen B. Church Company
Material Through Screen



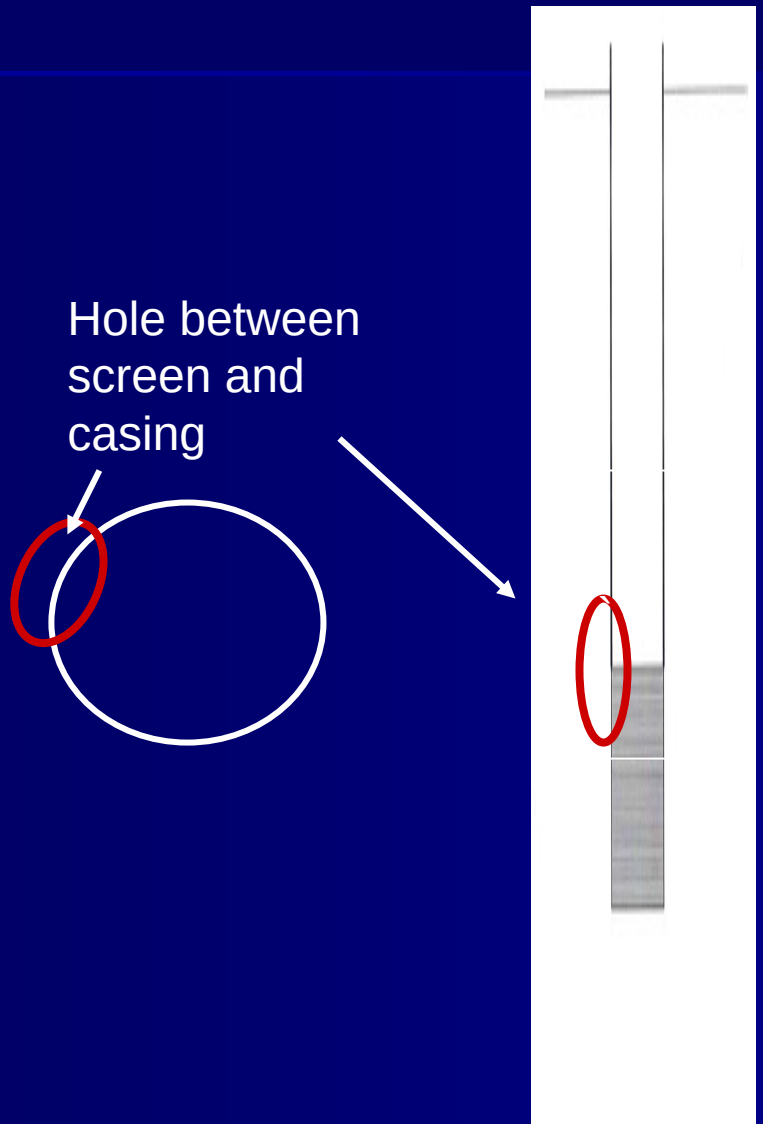
Original well screen slot size opening was .050 inch

About 75 percent of this sample will go through a .050 inch sieve

What does that tell us?

From video inspection of well

Hole between screen and casing



Slip a new well screen inside the old one

New one smaller in diameter and about 2 feet longer than the old one

Same slot size as the old one

With new screen in place, redevelop the well

Case History – Deformed screen

- 16 inch well
- Drilled by another contractor
- Bottom 3 feet of screen was bent and twisted
- Occurred during construction probably
- Well did not produce sand
- No repair needed

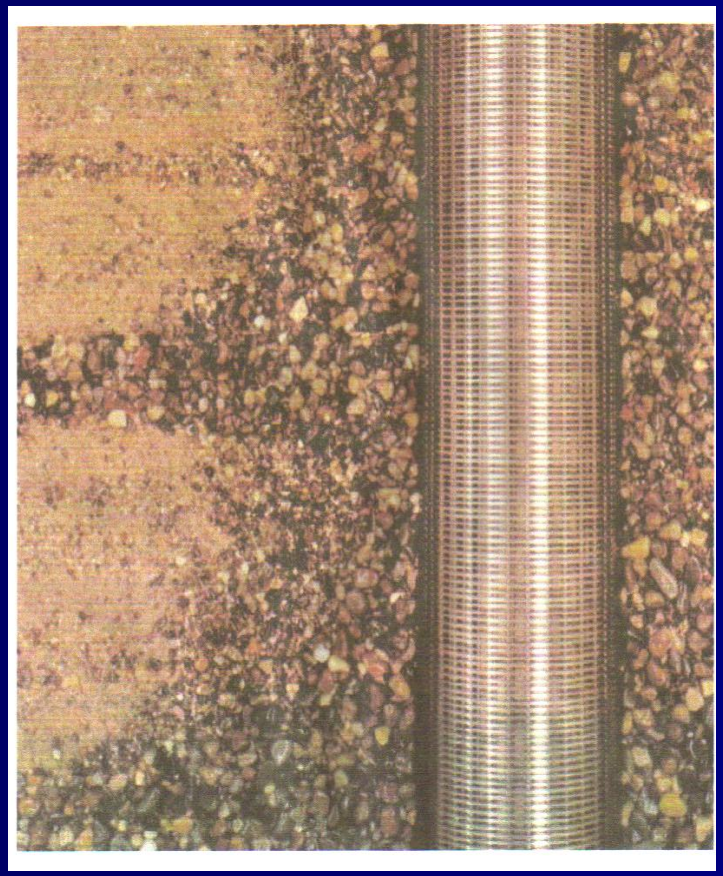
Case History – Well produces sand

- Sand can cause problem with control lines, settle in bottom of tanks, plug filters, etc
- Take sample, do sieve analysis

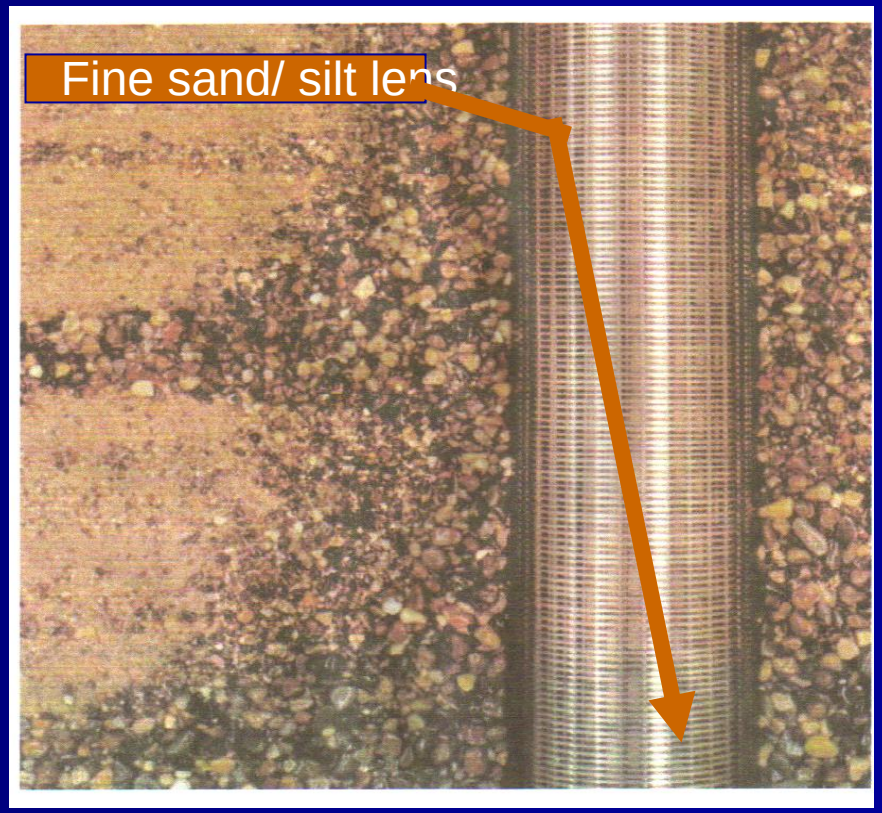
What does that tell us?

Screen slot size

“Sand-pumper” cause



Ideal condition



Can be the result of overpumping

How do you repair this?

- Material is too fine to rescreen the well
- Manage the well differently – Options include
  - Pump at a lower rate to slow down the water coming through the aquifer
  - Minimize starts and stops of the pump
  - Put pump on a soft start
  - Put pump on automatic blow-off for first ten minutes
- Replace the well

Case History – 25 year old well

- Reported to be 8 inch well
- 10 feet screen from 32 to 42 feet
- Measured well and found it was 33 feet deep with soft bottom
- Set air lift and cleaned out the well to 41 feet; took sample
- Did video
- Learned there was no screen in well

- No screen in well
- Bottom of casing at 38
- Holes in casing between 33 and 36 feet; all the sand is gone
- Open hole between 38 and 41- unstable
- Hard bottom at 41 feet
- This well needed screen and new casing installed
- Very fine material

Muni Pak Screen

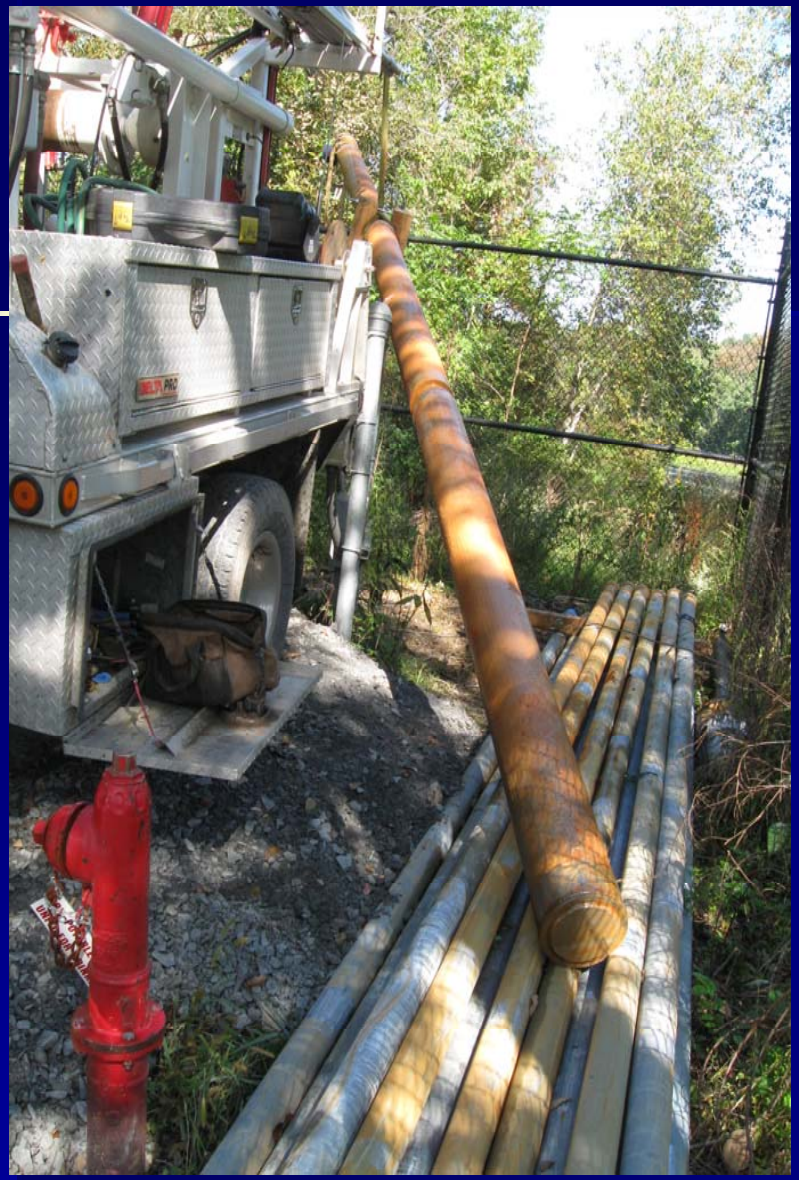
x

Muni Pak installed with new casing to sleeve the entire well

Redevelop the well

Deep screened rock well

- 10 inch diameter
- 347 feet deep
- 318 feet of casing
- Static level at 41 feet
- Had a very fine slot well screen in bottom 30 feet in “rotten rock”
- Originally rated at 100 gpm
- Pump was set at 273 feet
- Well capacity fell to 0, pump and screen were pulled



Completely plugged with red clay

Stainless steel screen, 30 ft long, 8.5 inches OD

- The top of the screen was at 317 feet and the bottom of the motor was at 280 feet

- When the pump was removed after it failed, the screen was attached to it

- Top of screen was deformed like it was hit with a hammer, bottom of motor was damaged

It looked like the pump had dropped repeatedly onto the top of the screen

What happened?

- With the screen was almost completely plugged, the well produces very little water; the pump shuts off from its safety
- Well casing slowly fills up
- The pump goes on; all the water in the casing pumps out in a couple of minutes; very little water can get into the well
- There is now an upward force of over 5000 pounds on the bottom of the screen trying to drive the screen upward
- The screen drives itself up until it contacts the bottom of the motor
- When the well fills up again, the screen falls back to the bottom
- The cycle repeats itself until something breaks

How do you fix it?

- Cut a hole in the bottom of the screen to eliminate the uplift

Clean out the screen

This screen was so badly plugged that it was almost watertight!

- There are many municipal wells in use that are 30 years old or more
- Maintenance is even more critical now because most of them are being pumped longer and harder than before
- Take care of your wells. In some cases, you may not be able to replace them.

- Keep track of yield and drawdown
- When yield decreases and drawdown increases, call in a well professional to determine if there is a problem
- Go into your pumphouses regularly to look and listen for problems

It is always easier and cheaper to solve problems when they are small than when they are allowed to get bigger

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