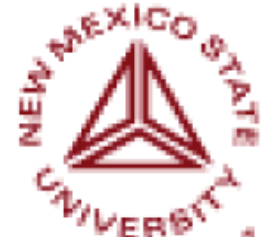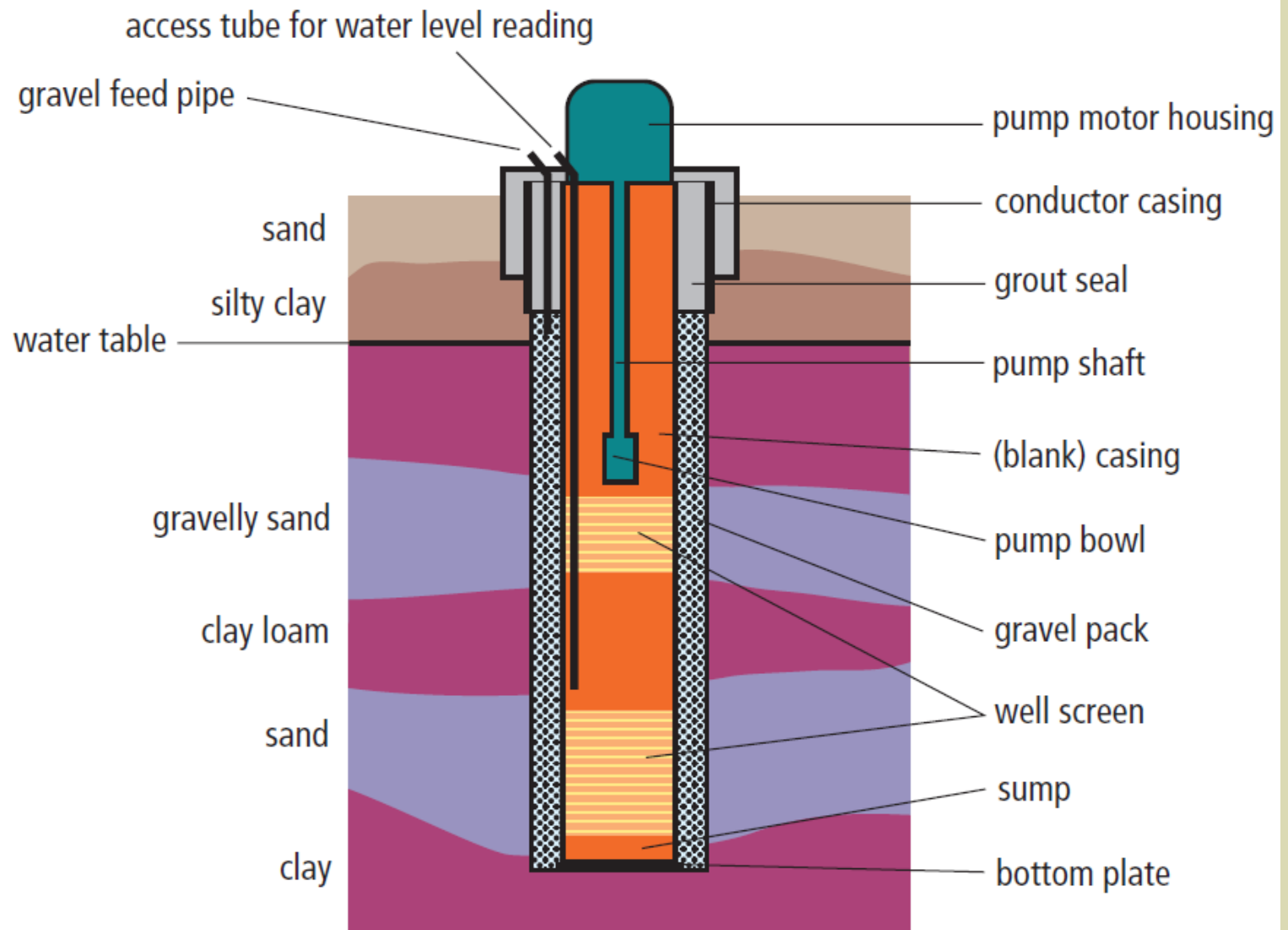# WELLS, PUMPS, ETC......

Principles of Wells & Pumps

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Properly Constructed Water well

Where to Start?

1- How much flow ?

2- Diameter?

3- Depth ?

4- Cost ?

Objectives

- Pump the required Flow (Q/volume) with minimum cost.

- Cost = initial cost + energy cost + labor cost

- The longer the screen, the less energy cost

How Much Flow?

- Q = 10 gpm/acre (for continuous irrigation)

- If irrigating once every two weeks;

  Q = 10 X 14 = 140 gpm/acre (24 hours of Irrig. time)

  If irrigating once a week;

  Q= 70 gpm/acre (24 hr of irrig. time),

  Or 35 gpm/acre (48 hour irrig. Time)

What Diameter?

Discharge Q, gpm or L/s		Minimum Casing Diameter in or mm	
(gpm)	(L/s)	(in)	(mm)
1770 RPM			
<150	9.5	8	200
150-600	9.5-38	8-10	200-250
600-1000	38-63	10-12	250-305
1000-2500	63-158	12-14	305-355
2500-3000	158-189	14-16	355-406
3000-5000	189-315	16-20	406-508
5000-7000	315-442	20-22	508-560
7000-9000	442-568	22-26	560-660
3450 RPM			
<120	7.6	4-6	102-152
120-400	7.6-25	6-8	152-200
400-1000	25-63	8-10	200-250
1000-1400	63-88	10-14	250-355

Depth ?

- 1. How many feet of screen?

- 2. How many feet of casing

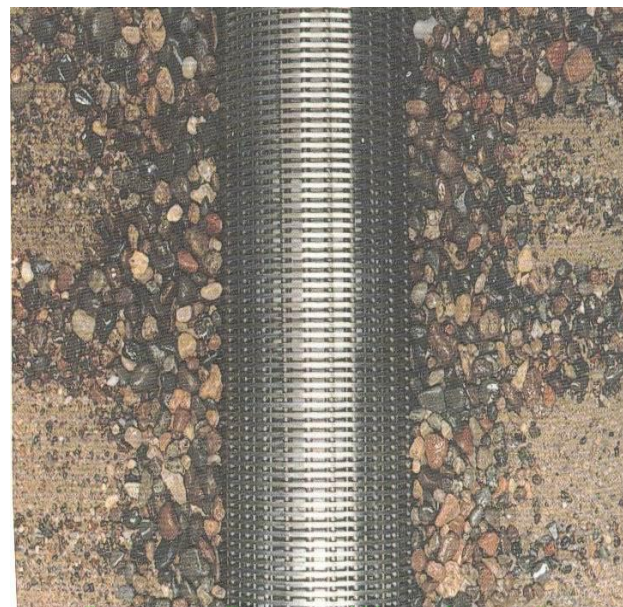- Total Depth = Screen length + casing length + 20 ft

Well Screen

Slotted pipe

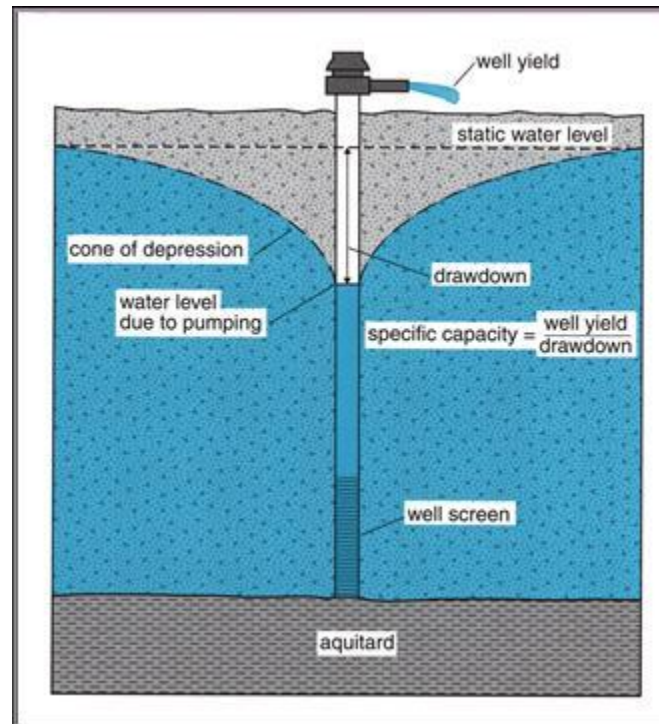Louvered

Bridged

Wire Wound

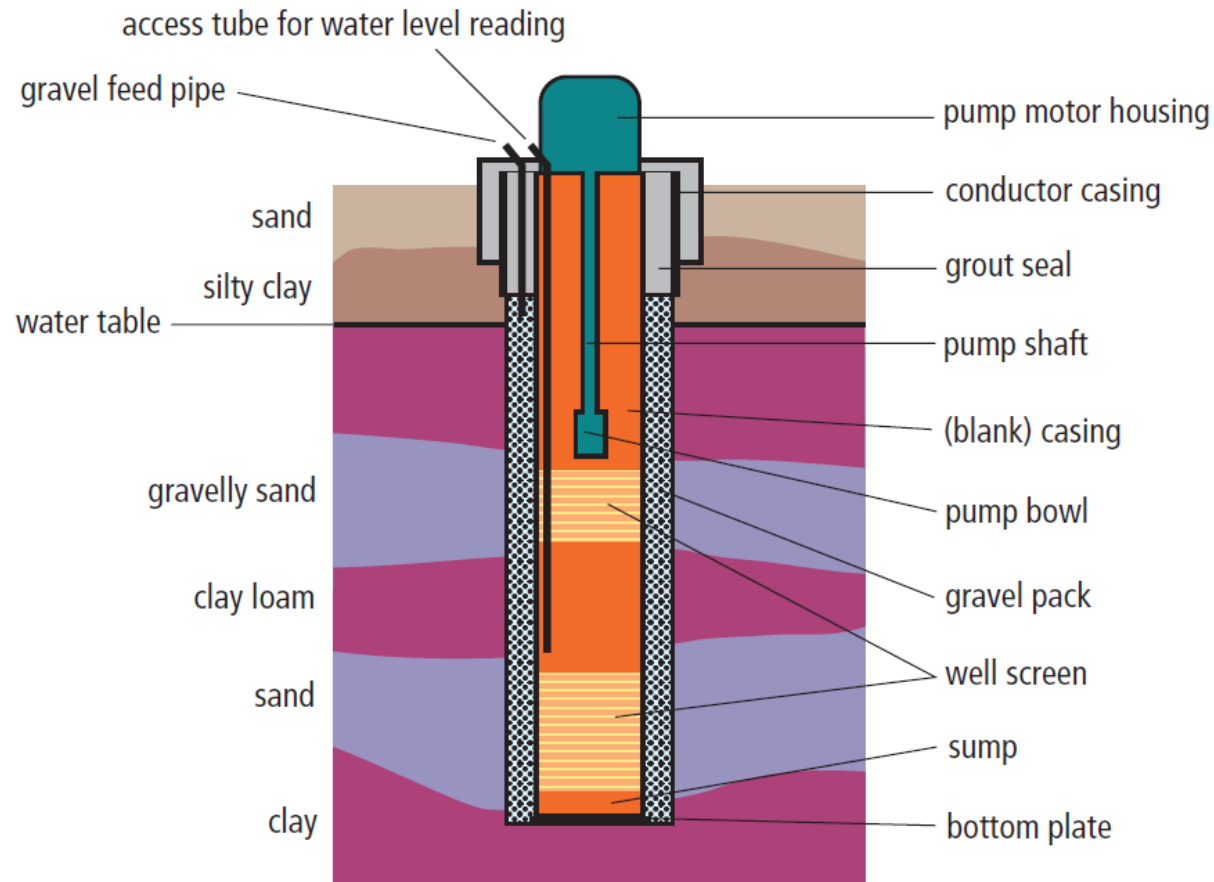# What is the purpose of screen ?

- To allow water into well

- To prevent sand from coming into well

# Drawdown vs Screen length
longer screen=less drawdown

Where to put the screen?

access tube for water level reading

gravel feed pipe

sand

silty clay

water table

gravelly sand

clay loam

sand

clay

pump motor housing

conductor casing

grout seal

pump shaft

(blank) casing

pump bowl

gravel pack

well screen

sump

bottom plate

Screen Location

- Screen is placed on productive zone
(sand + gravel area), with good water quality

- Drawdown depends on
Permeability of material + Length of screen
+ screen type

The higher the "K", the less screen you need
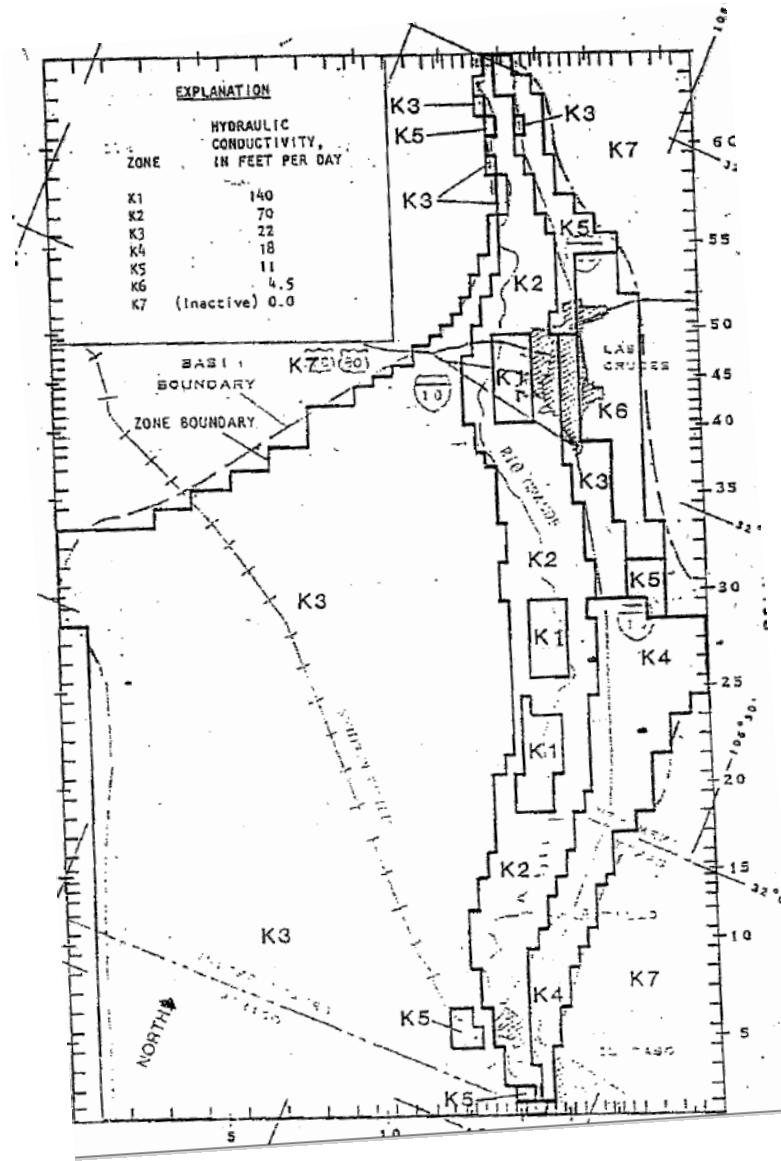
Sand Pumping

1. Damages the impeller, bearing, shaft…

2. Reduces efficiency, flow
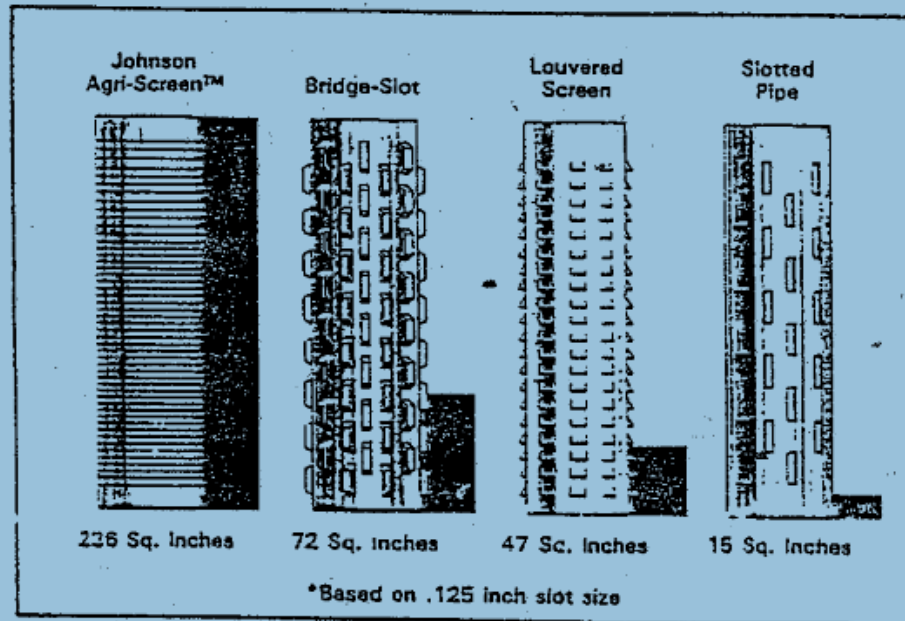
3. Fills up the well, and reduces life expectancy

How to prevent sand pumping?

- Sand pumping depends on:

  Screen Length + screen type

- Gravel pack

Screen type is critical

Johnson Agri-Screen™ — 236 Sq. Inches
Bridge-Slot — 72 Sq. Inches
Louvered Screen — 47 Sc. Inches
Slotted Pipe — 15 Sq. Inches
*Based on .125 inch slot size

Minimum Screen length

$$Min-screen-length = \frac{Q}{opening\,(in^2\,/\,ft)*0.31}$$

Longer screen length and more opening = less sand pumping

Length of casing

Casing length = SWL + drawdown+ 30 ft (min)

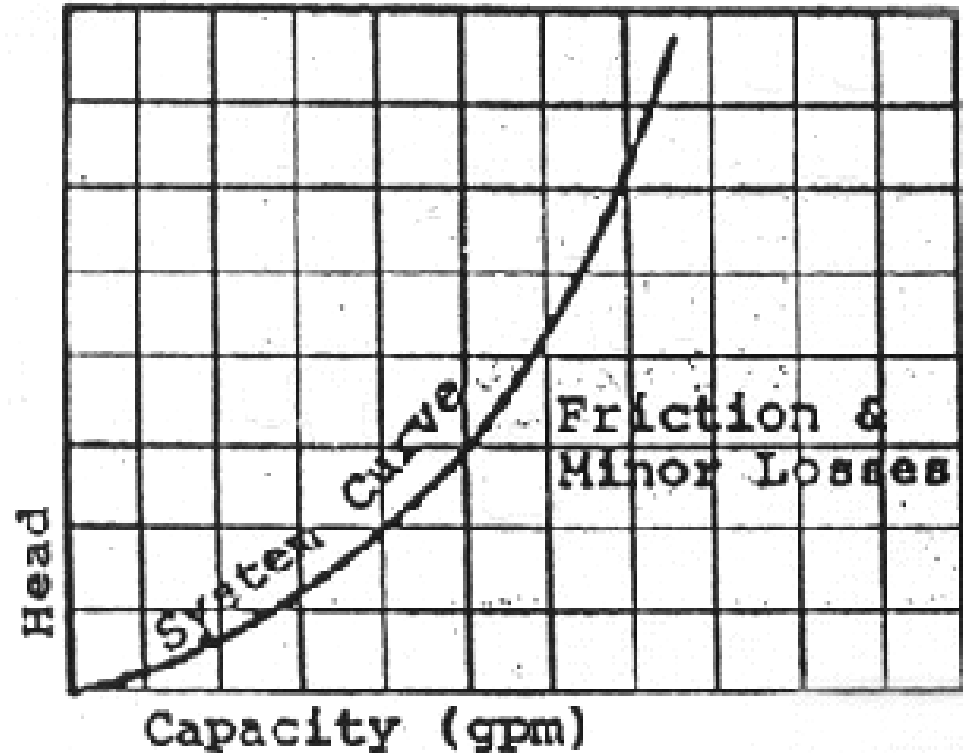Total Depth = Screen length + casing length + 20 ft

Gravel Pack

- The function of gravel pack;

1. To reduce drawdown

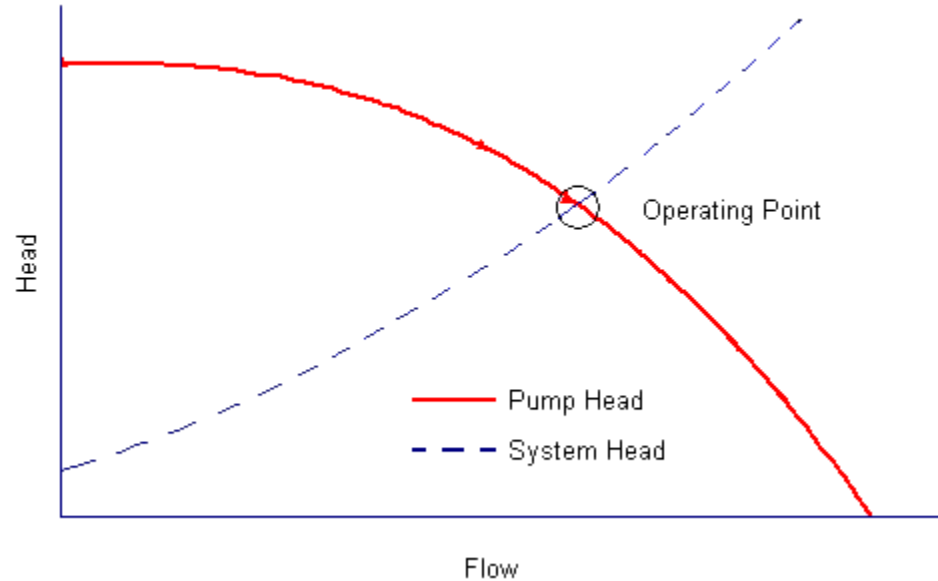2. To prevent sand pumping

The steps

1. Design the well
2. Drill the well
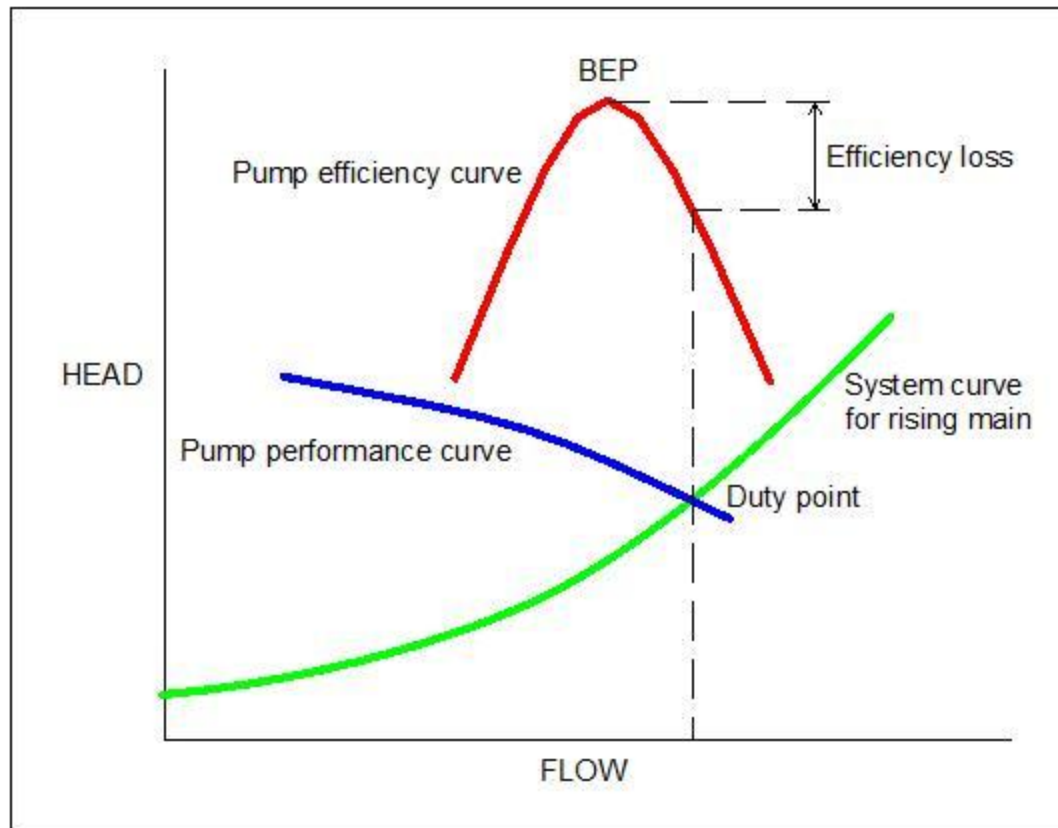3. Develop the well
4. Test the well
5. Select the pump
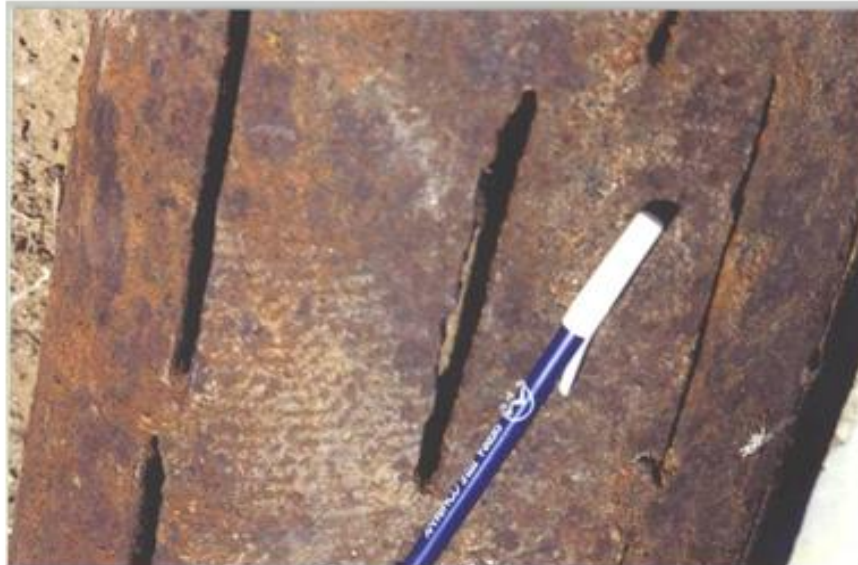
System curve

Pump & system curve

Efficiency?

The perfect pump should

- Provide the Q
- Provide the (lift + friction loss)
- Have high efficiency
- Operate on the right hand side of peak eff.

Examples of poor screen + Gravel Pack

This oversized screen in Hermosillo, Mexico
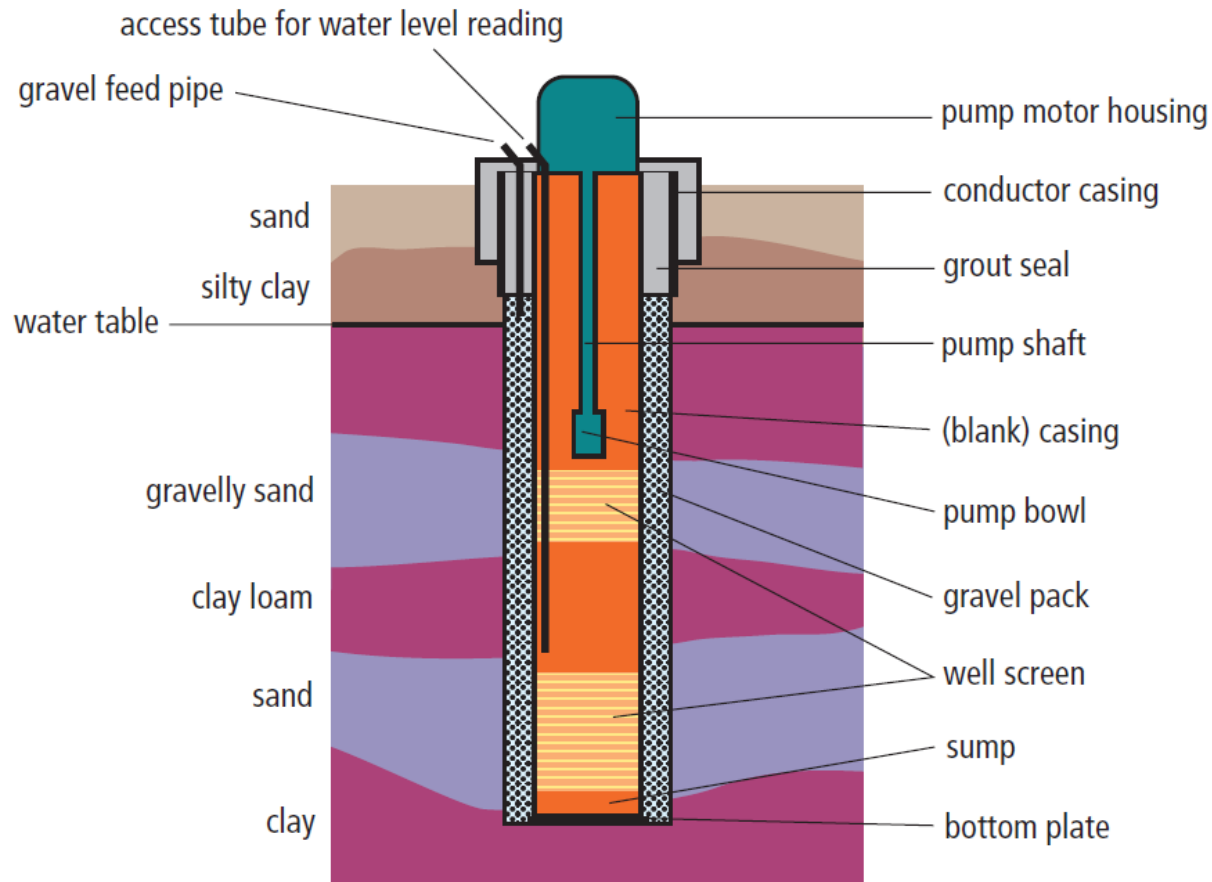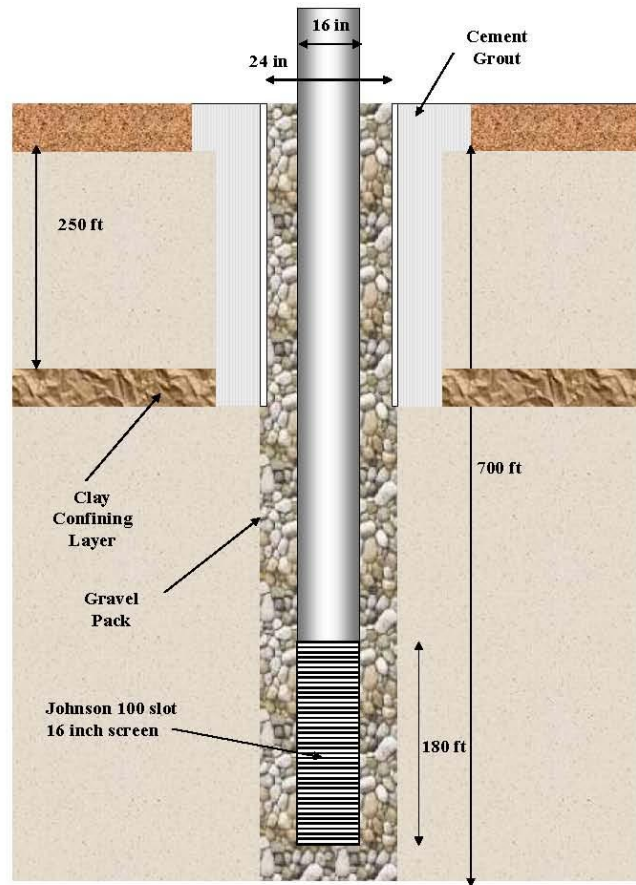Resulted in failure of a well

This is not a screen

This is not a gravel pack

Access tube for the future

Grout Seal for water quality

Thank You

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wells.pumps.etc@gmail.com