Managing Your Groundwater Supply

March 7, 2018

All About Irrigation Workshop

Tidewater Agricultural Research
and Extension Center
Suffolk, VA

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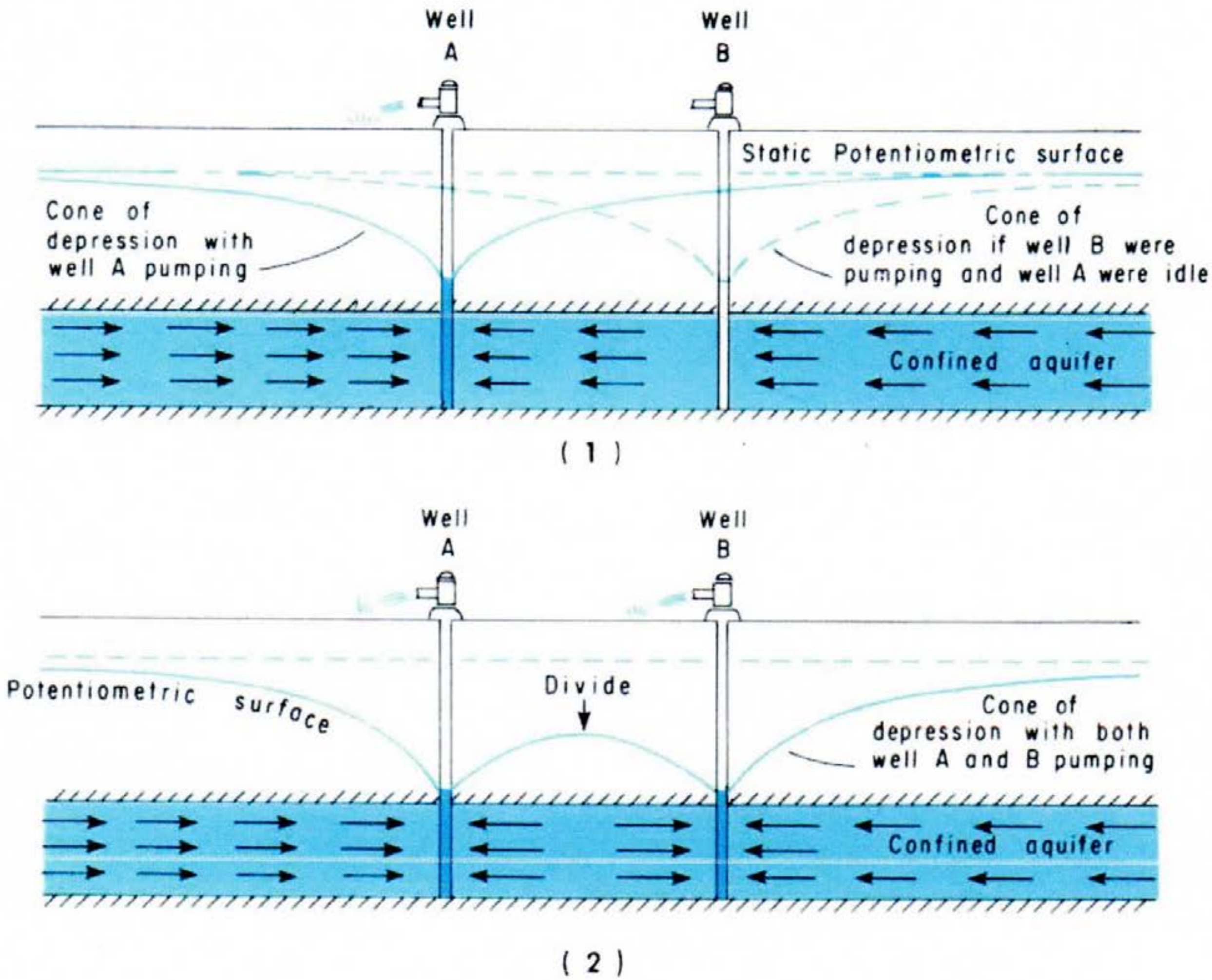
GeoResources INC
HYDROGEOLOGICAL CONSULTING AND SERVICES

Summary Recommendations:

- Pick your best aquifer (for new wells or for adding wells):
  - Consider alternatives, such as Columbia (surficial) aquifer;
  - Coordinate planning with the VA DEQ to gain insights and avoid hitting regulatory walls.
- Well interference – space wells and spread pumping:
  - Well driller may have a feel for sufficient spacing (for given aquifer and drawdowns);
  - Increase spacing in central area of well field or line of wells;
  - If only pump some wells at the same time, spread which wells are pumping simultaneously.
- Well efficiency – is your pumping level falling? If yes, is it falling more inside the well than outside the well?

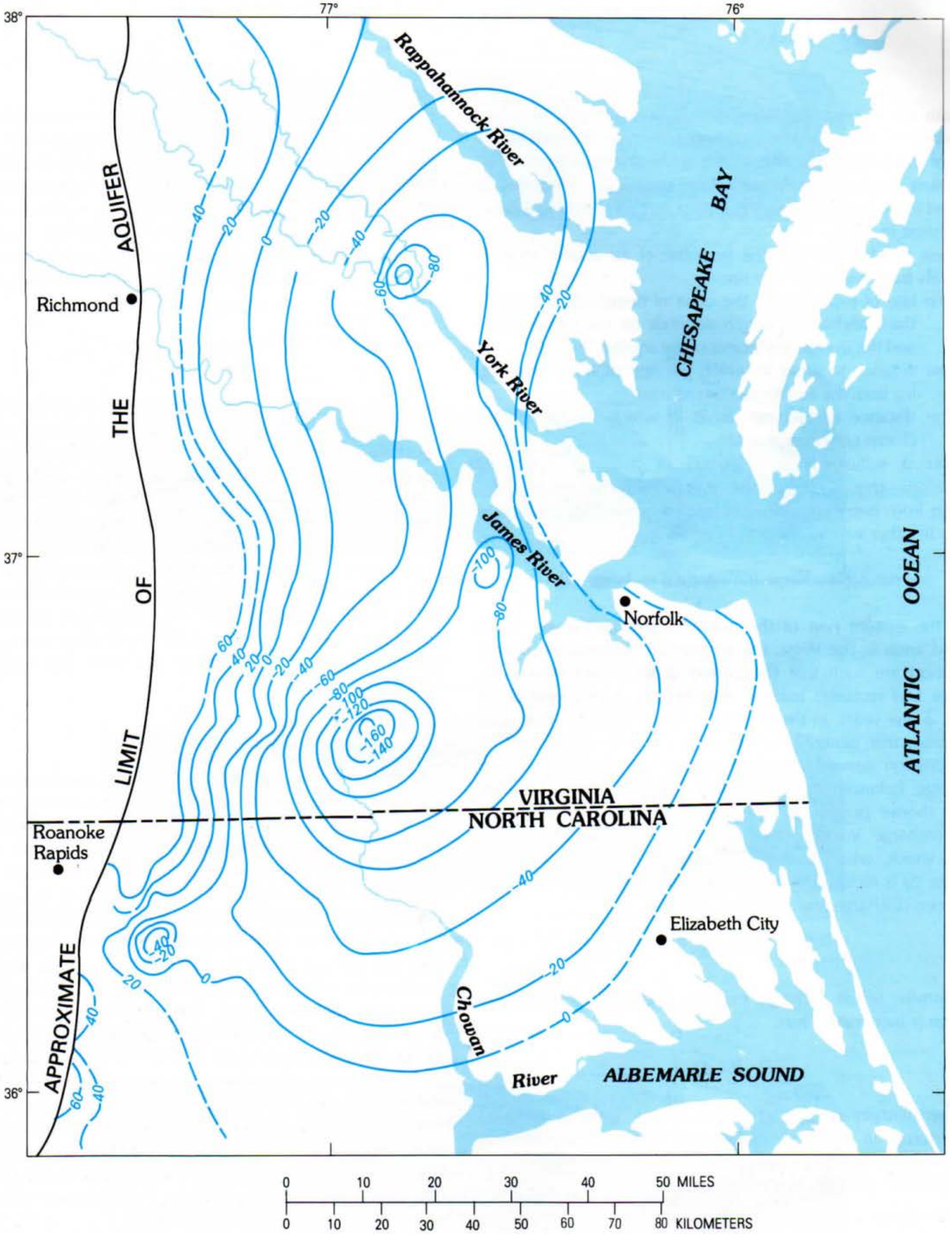


Source: U.S.G.S. Water-Supply Paper 2220, 1983.

Transmissivity and Storativity ("T and S") (key hydraulic properties for how drawdown impacts extend out from a pumping well):

- Unique for each different aquifer (distance-drawdown impacts differ);
- Vary within the same aquifer for different locations/directions.

POTENTIOMETRIC SURFACE OF THE LOWERMOST CRETACEOUS AQUIFER IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA



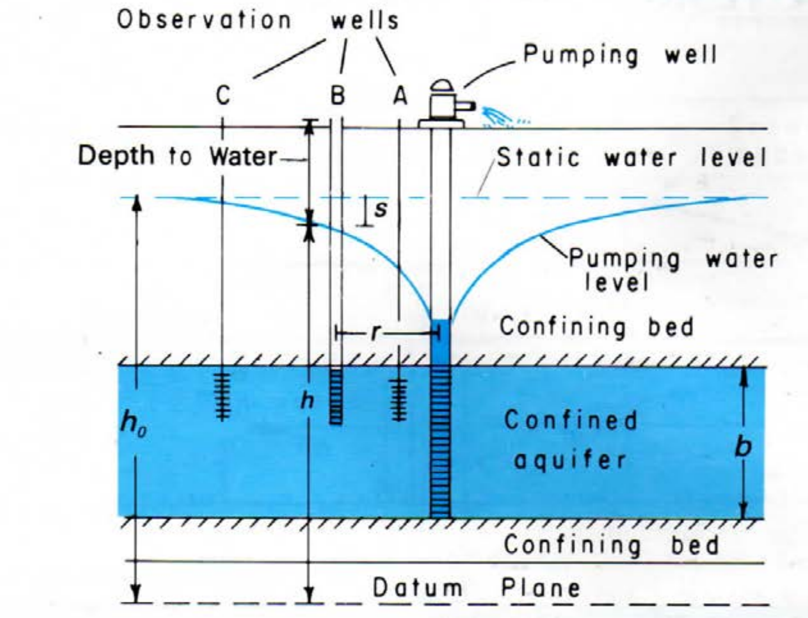
EXPLANATION

Water levels are in feet

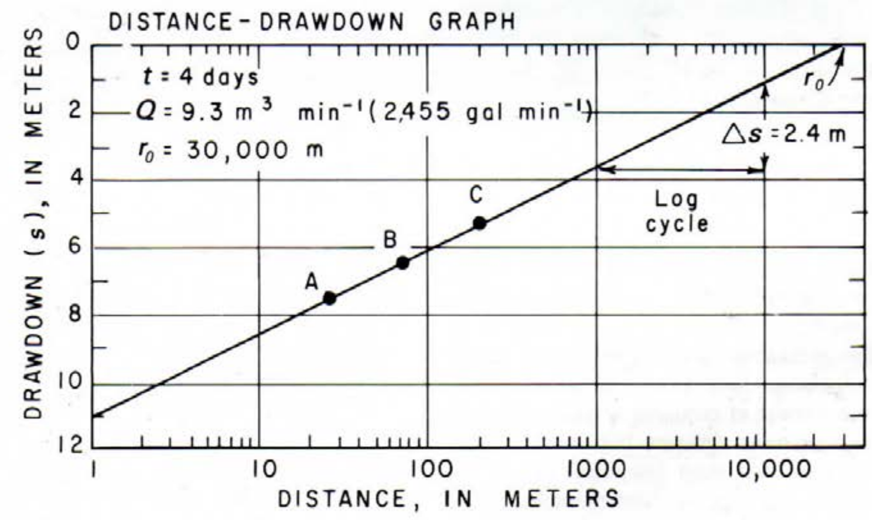
NATIONAL GEODETIC VERTICAL DATUM 1929

(3)

Source: U.S.G.S. Water-Supply Paper 2220, 1983.



(1)



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Modified from U.S.G.S. Water-Supply Paper 2220, 1983.

**Distance-Drawdown plot (Jacob method)
at 48 hours elapsed pumping time**

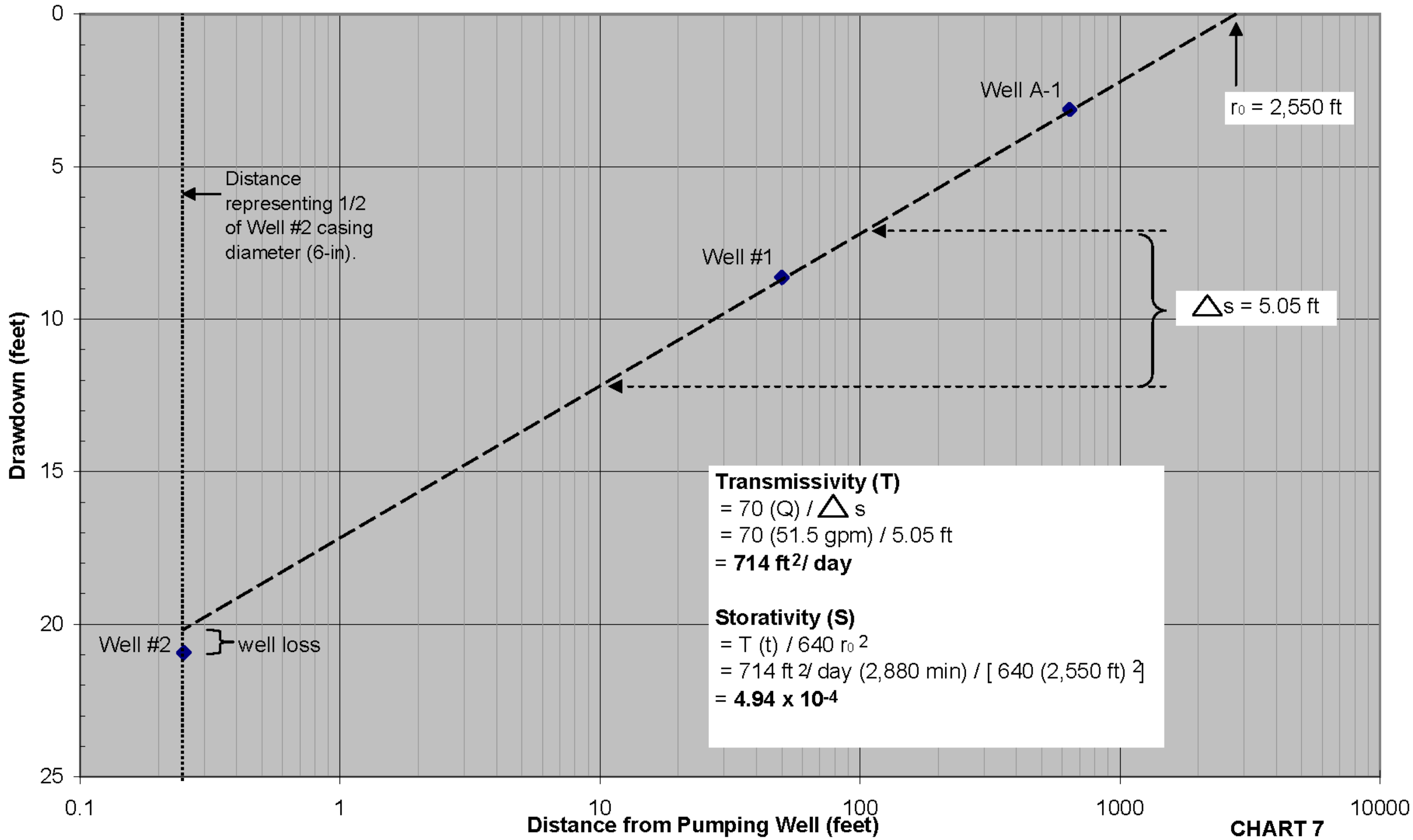

CHART 7

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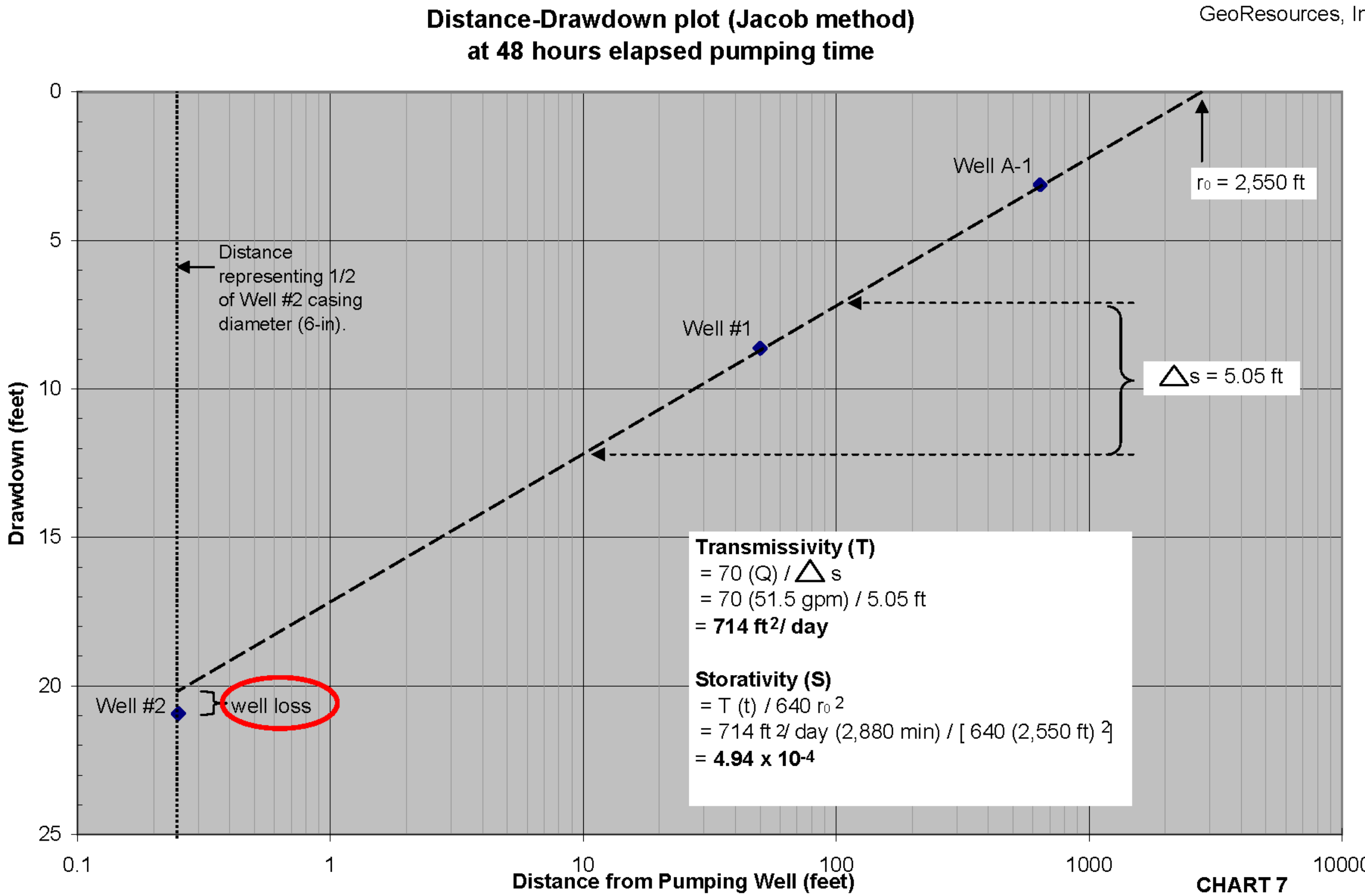

Distance-Drawdown plot (Jacob method)
at 48 hours elapsed pumping time
Drawdown (feet)
0
5
10
15
20
25
0.1
1
10
100
1000
10000
Distance from Pumping Well (feet)
Distance representing 1/2 of Well #2 casing diameter (6-in).
Well A-1
Well #1
Well #2
well loss
r0 = 2,550 ft
Δs = 5.05 ft
Transmissivity (T)
= 70 (Q) / Δ s
= 70 (51.5 gpm) / 5.05 ft
= 714 ft2/ day
Storativity (S)
= T (t) / 640 r0 2
= 714 ft 2/ day (2,880 min) / [640 (2,550 ft) 2]
= 4.94 x 10-4

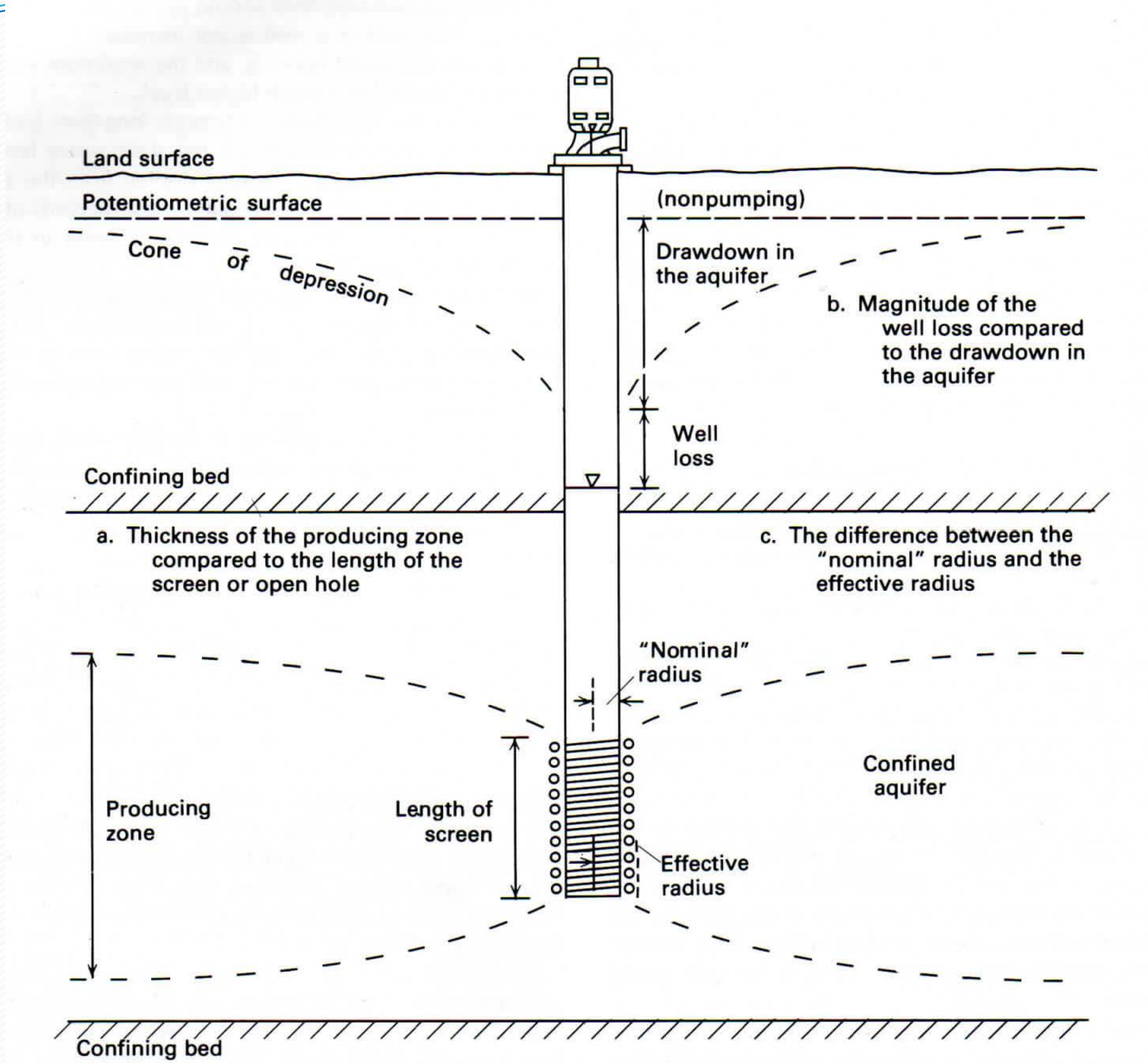
CHART 7

Well Loss (well efficiency):

- No way to easily measure (short of aquifer testing, and no *good* way to do it short of multiple observation wells),

BUT…

- If you can measure water levels in your well, you can monitor changes/trends in performance.



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Yield versus Specific Capacity

<u>"100 gallon-per-minute well"</u>

Static water-level depth = 70 feet
Pumping water-level depth = 120 ft
(after say, 2 hours)

<u>Specific Capacity of well</u>

$= [100 \text{ gpm}/(120\text{-}70 \text{ ft})]_{2\text{-Hr}}$

$= [100 \text{ gpm}/(50 \text{ ft})]_{2\text{-Hr}}$

$= (2 \text{ gpm/ft})_{2\text{-Hr}}$

<u>"100 gallon-per-minute well"</u>

Static water-level depth = 70 feet
Pumping water-level depth = 80 ft
(after say, 2 hours)

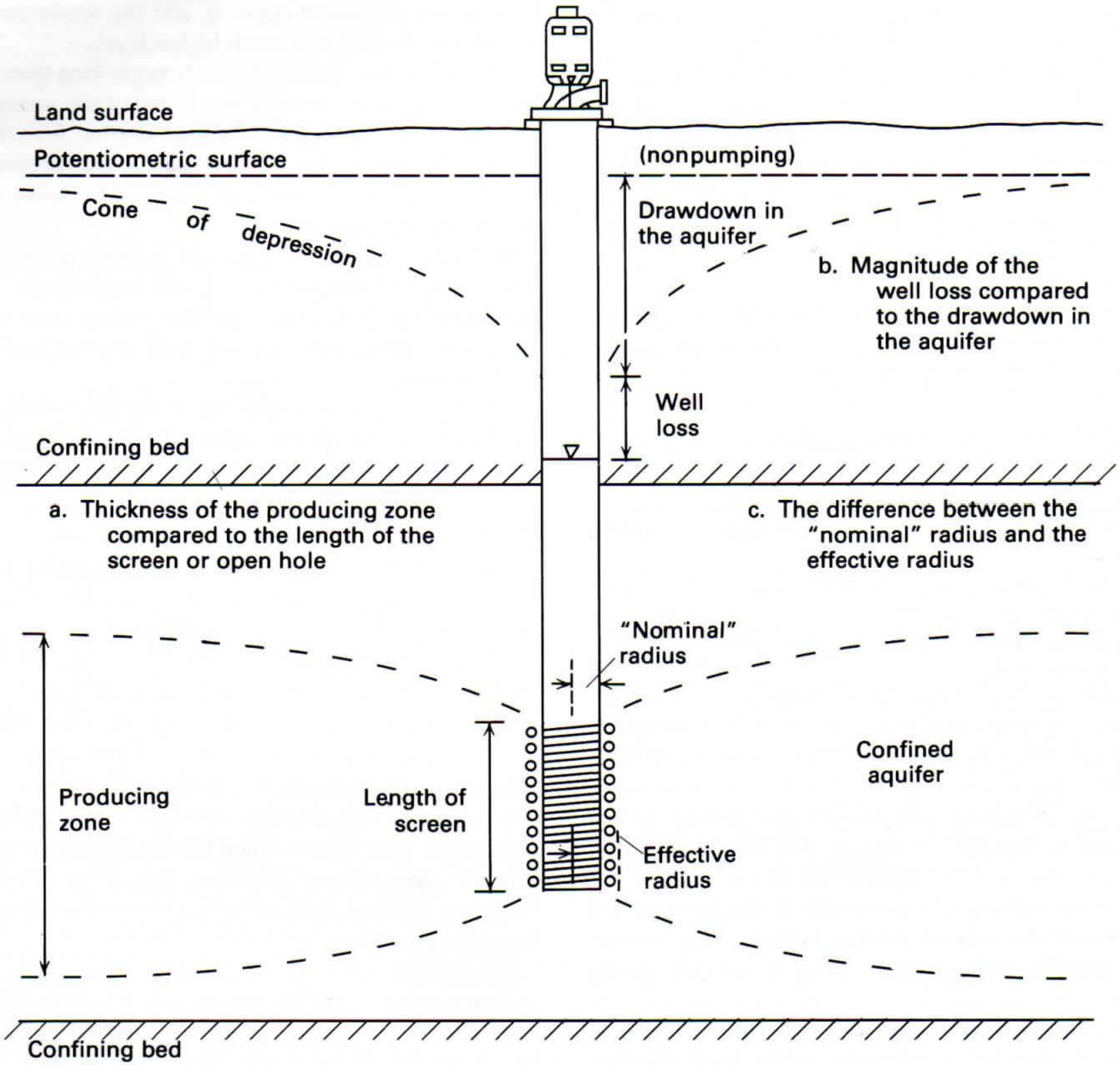
<u>Specific Capacity of well</u>

$= [100 \text{ gpm}/(80\text{-}70 \text{ ft})]_{2\text{-Hr}}$

$= [100 \text{ gpm}/(10 \text{ ft})]_{2\text{-Hr}}$

$= (10 \text{ gpm/ft})_{2\text{-Hr}}$


Well # 4 6" Well
140' Deep 14' SCREEN
60' WAter Level
8' Drawdown at Gal PM
6 8' gpm At 40 lbs
PUMP 120'
WELL-X-TROL
BY AMTROL



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