

Developing Ponds and Wells in Kentucky

Presented by

USDA NRCS

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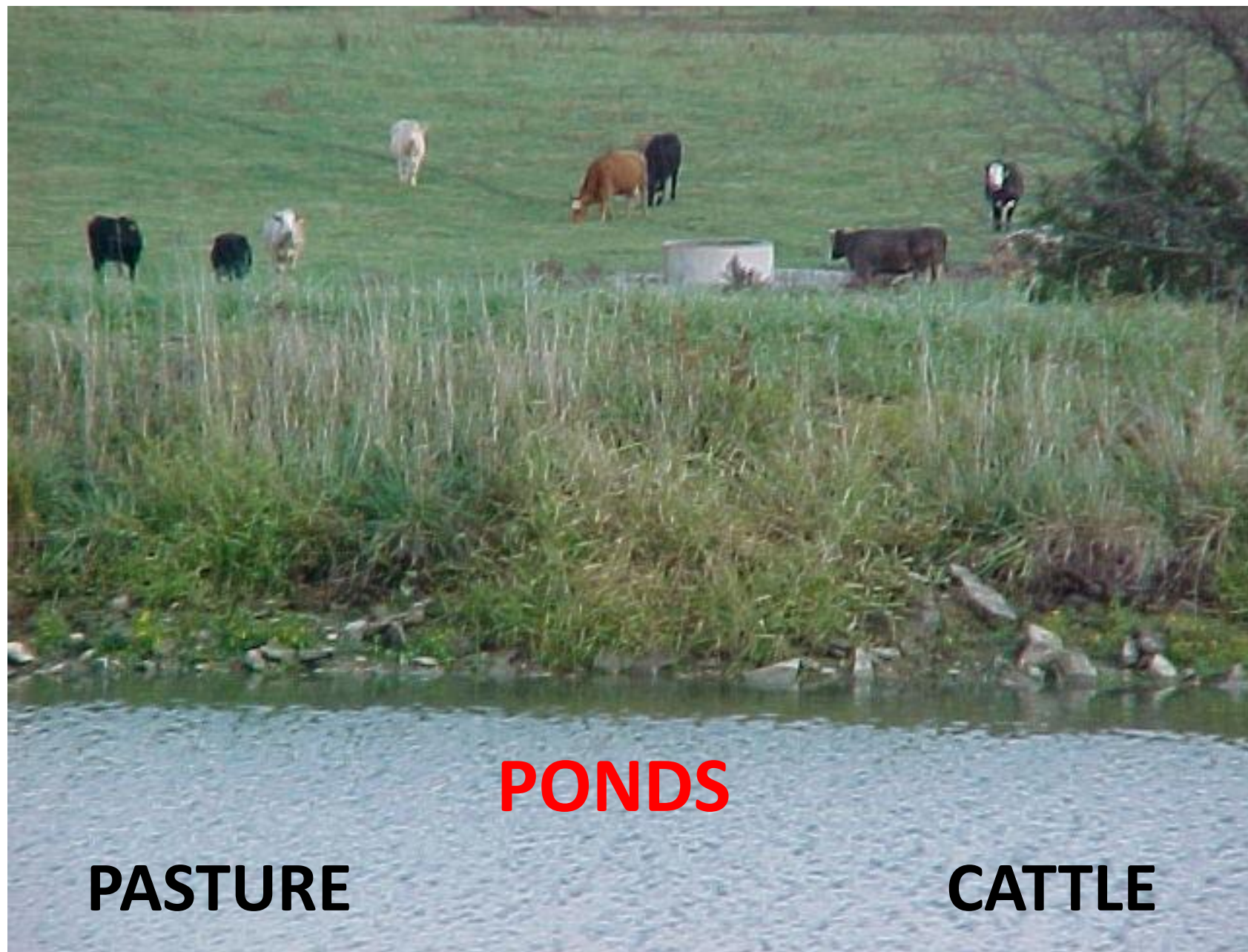
Where's the water going to come from for pasture, crops and cattle?

Selected excerpts from:

CONNECTING SURFACE WITH SUBSURFACE

Created by: PAUL HOWELL, NRCS GEOLOGIST

Presented by: R. Coleman Gusler, NRCS State Conservation Engineer



SOURCES OF RURAL WATER

- STREAMS
- SPRINGS
- WATER DISTRICTS \$5.30/1,000 gal
- WELLS
- PONDS
- COMBINATIONS OF ABOVE

PONDS *are about*
rainfall, runoff, evaporation
watershed size & character
pond depth & surface area

- **With few exceptions most ponds get their water from a combination of rainfall directly into the pond, and rainfall runoff from the pond's watershed. Rainfall in this area is about 43 inches annually. Runoff is about 16 inches annually. Generally, in Kentucky we like a minimum of 3 to 5 acre watershed per one acre pond surface. A good pond design does not build "the bridge wider than the road", nor "the bridge narrower than the road". A good pond design matches the pond to fit the watershed.**

P O N D S *are about ...*

need & purposes

other options

site selection & suitability

*subsurface characterization
(soils & bedrock)*

design & construction

management of usage

subsurface leakage treatments

PICKING A GOOD POND SITE

SUBSURFACE SUITABILITY

- **THE PROCESS**

EVALUATING THE SUBSURFACE

SOILS (EXAMINE SOILS INFORMATION)

BEDROCK (EXAMINE GEOLOGIC MAPS)

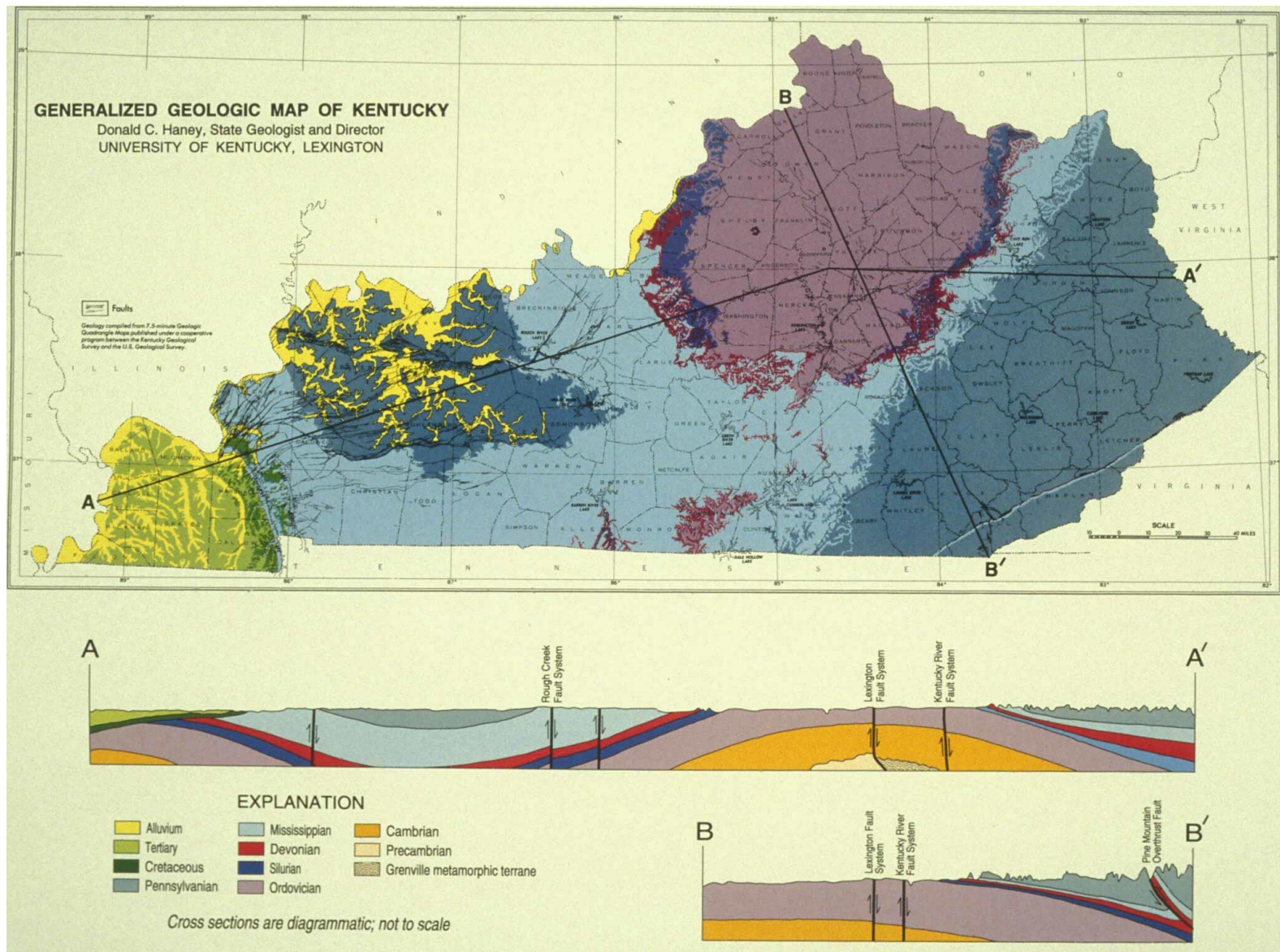
EXPLORATION BORINGS

BACKHOE EXPLORATION PITS

SITE VISIT & EXPERIENCE

PICKING A GOOD POND SITE

- Pond sites are like real estate.
- The most important thing is location, location, location.

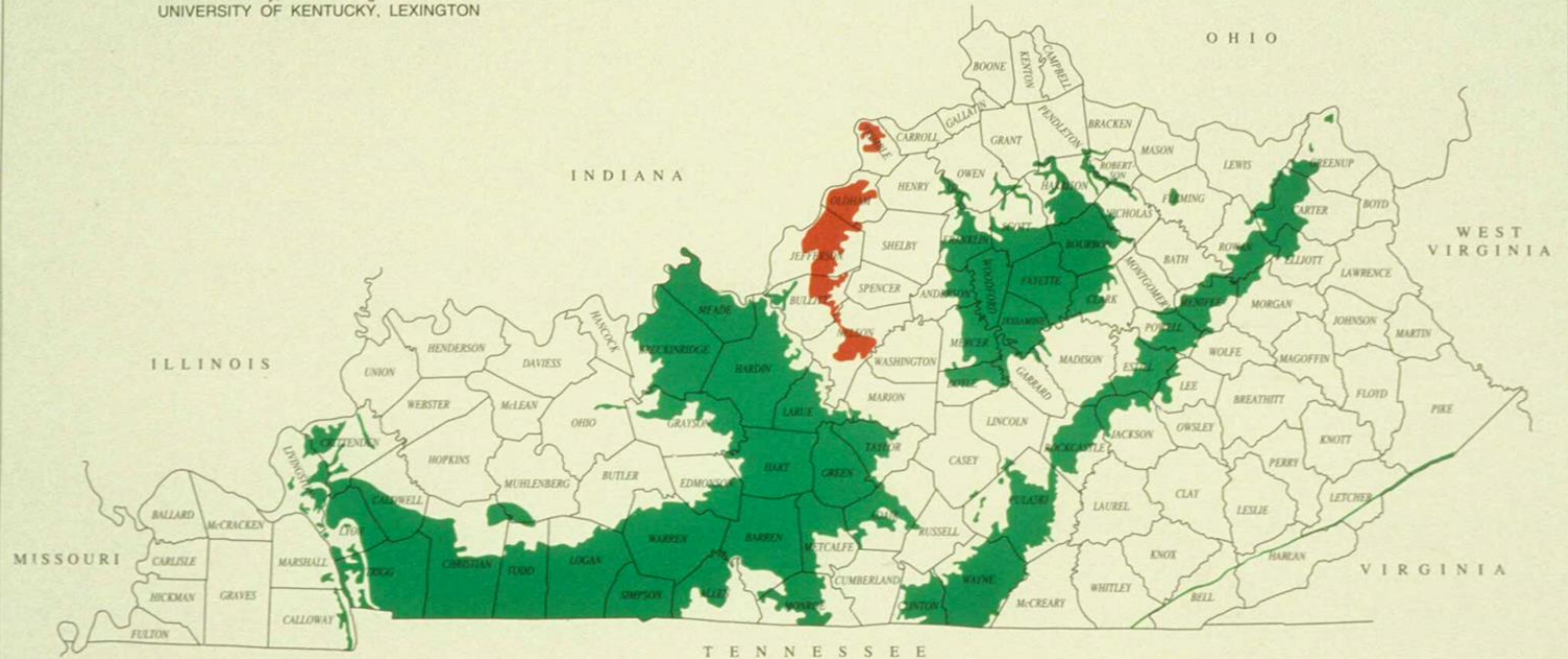


Generalized Geology of Kentucky

“Layer Cake”

KENTUCKY GEOLOGICAL SURVEY

Donald C. Haney, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

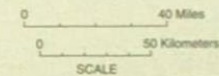


PRINCIPAL OUTCROP OF LIMESTONE AND DOLOMITE RESOURCES IN KENTUCKY

Compiled by Garland R. Dever, Jr.

EXPLANATION

- Limestone
- Dolomite and dolomitic limestone



1996

Limestone & Dolomite, Kentucky
“KARST COUNTRY”

- **Bedrock becomes permeable (develops openings, small to large) in the upper few to several feet due weathering, fracturing, and bedding plane separation. The degree and the depth to which this weathering process occurs varies with bedrock type, but it is often within this permeable zone that leakage develops. One of the construction measures to block this potential leakage is to excavate a “cutoff trench” to unweathered bedrock beneath the centerline of dam. The floor of this trench needs to notch into the unweathered bedrock up to about 2 feet or so above permanent pool elevation. This trench is then backfilled with compacted clayey soil, a “subsurface dam” so to speak, thus creating a hydraulic barrier to subsurface leakage. This is the “second line of defense” against leakage.**

Logan County, KY

Renault Limestone



Ground surface response to rainfall event?

Is this a groundwater recharge area?

Is this a low risk pond site?

Fayette County Overbrook Farm



Cutoff trench to fresh bedrock

Soils and farming?

House site w or w/o basement?

Ground water recharge area?

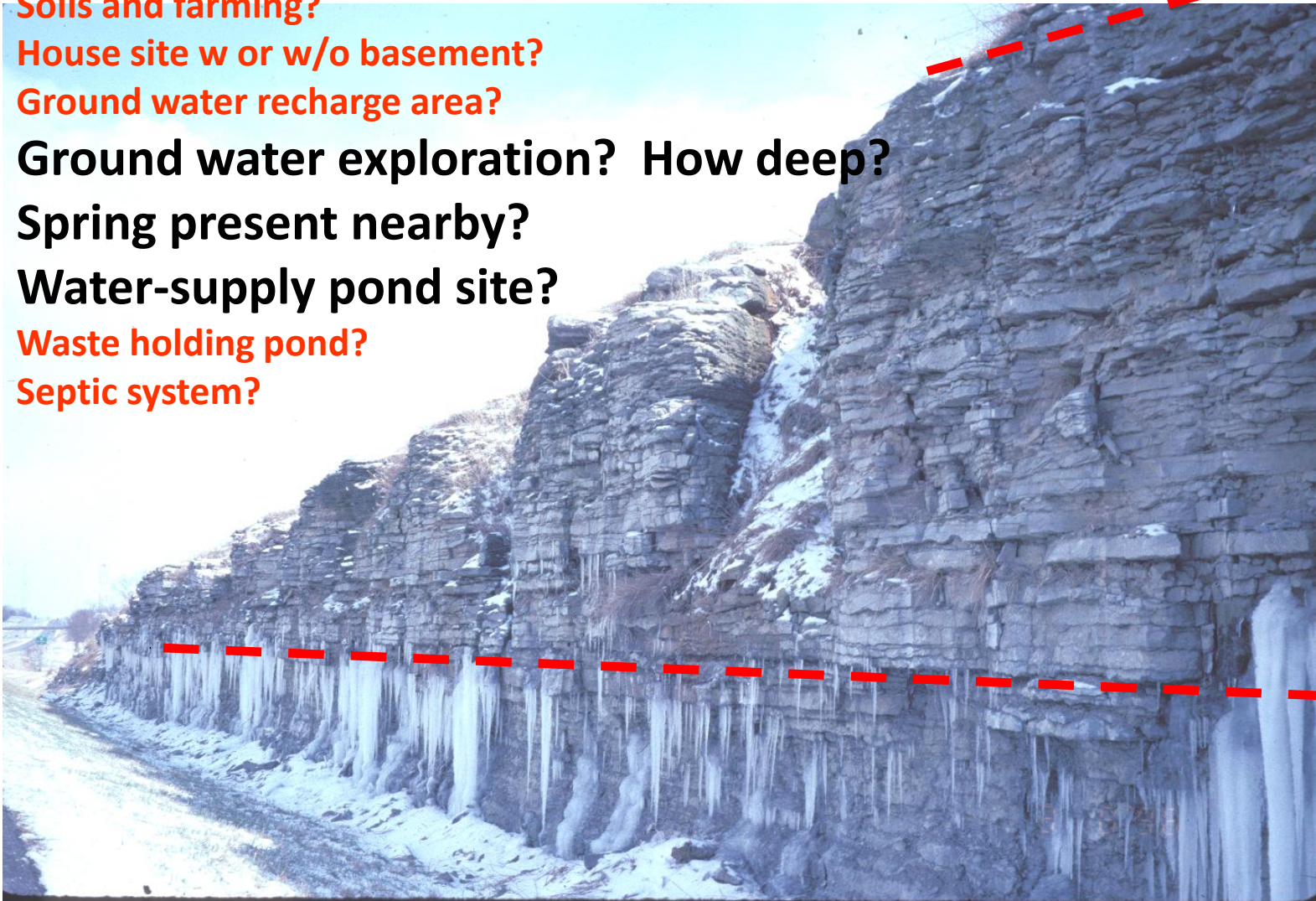
Ground water exploration? How deep?

Spring present nearby?

Water-supply pond site?

Waste holding pond?

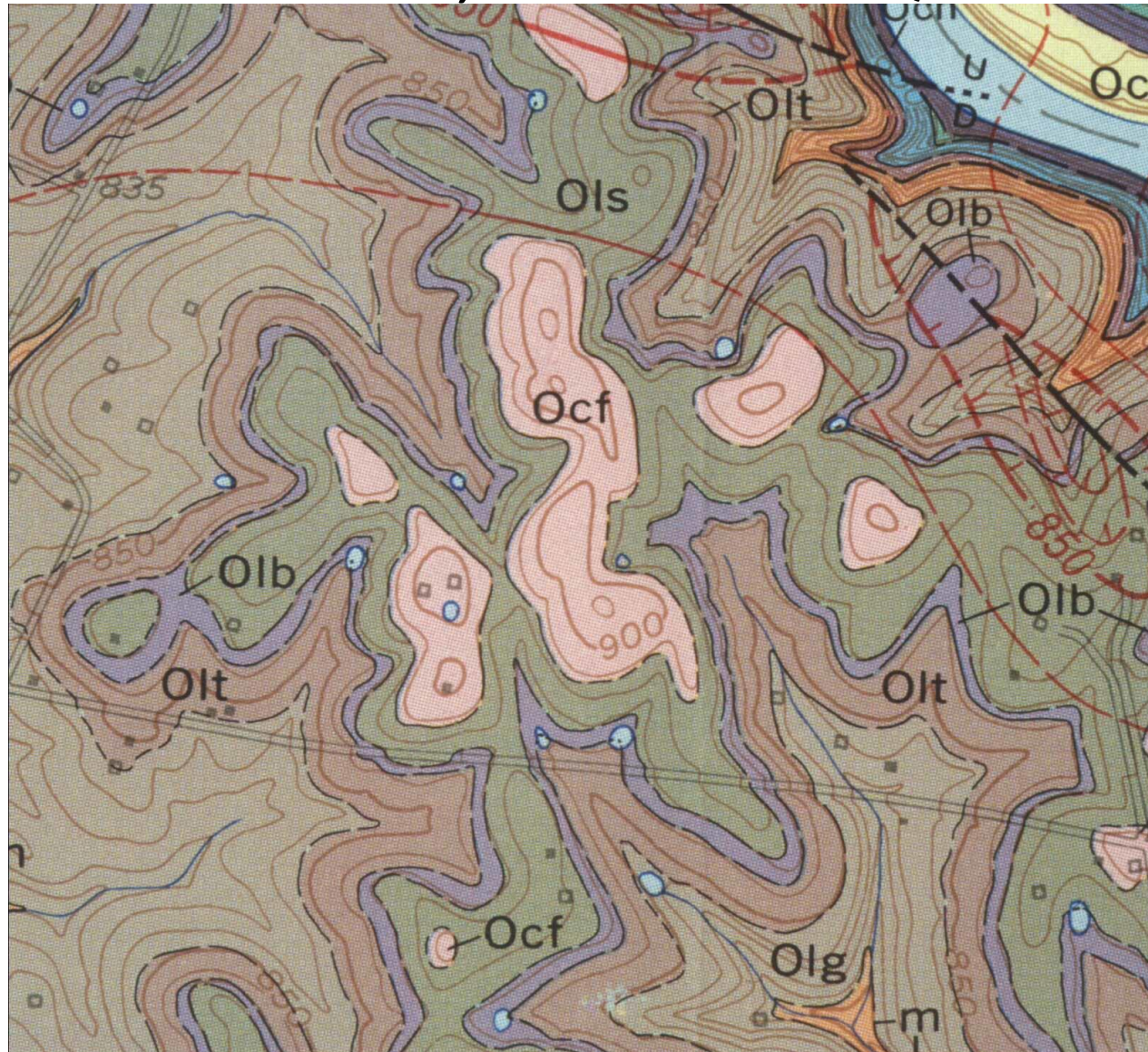
Septic system?



Tang

Bran

**PERMEABLE OVER IMPERMEABLE
FROZEN SEEPAGE**



~ 800 ac.

10 ponds
Ols/Olb

2 ponds
Olt/Olg

Ponds associated with Ols/Olb and Olt/Olg
What is the message here?

SCOTT Co., KY

PERM



Olt

IMPERM



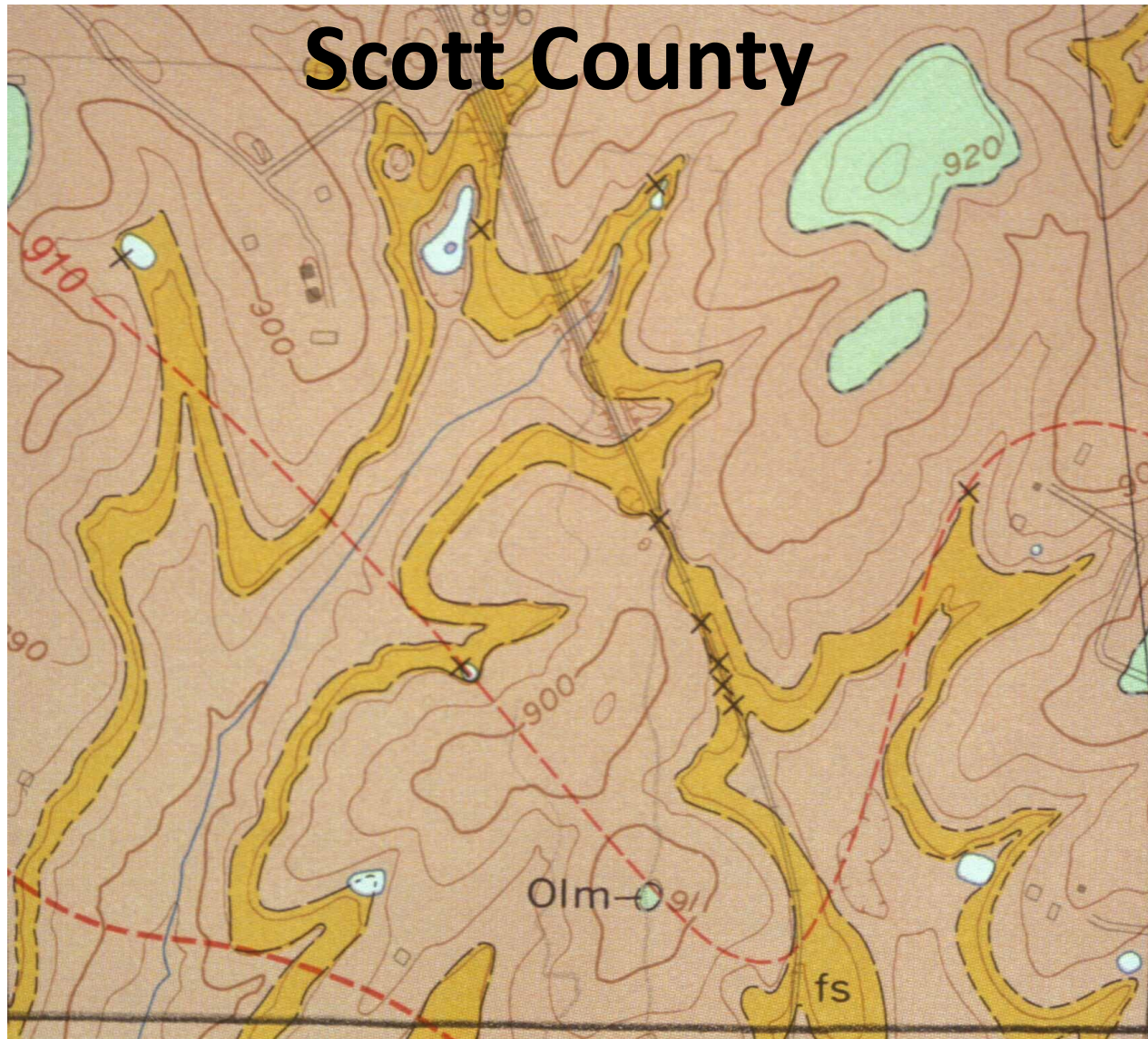
fs

Spring at Olt / fs contact

WHERE DID THE PIONEER BUILD HIS LOG CABIN?

Scott County

~ 500 Ac.



7 ponds
Olm/"fs"

Ponds associated with "fs" layer.

Lineament N.W. part of Royal Spring gw basin.

Woodford Co., KY

DOING THINGS RIGHT



**A 5 acre lake for about \$12,000 on the Brannon Mbr.
Soybeans on the Maury / Tanglewood.**

P O N D S *are about*

construction

- Many of the bedrocks beneath the soils in Kentucky are permeable, and should not be exposed in the pond basin. It is usually advisable to have about one or more feet of compacted clayey soils over bedrock in the basin area. This “**clayey blanket**” denies the pond water access to the potentially leaky bedrock. This clayey blanket is the “**first line of defense**” against subsurface leakage.

\$

\$

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\$

WHAT HAPPENED

TO

MY POND?

\$

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PREDICTABLE ?

Fayette County Pond

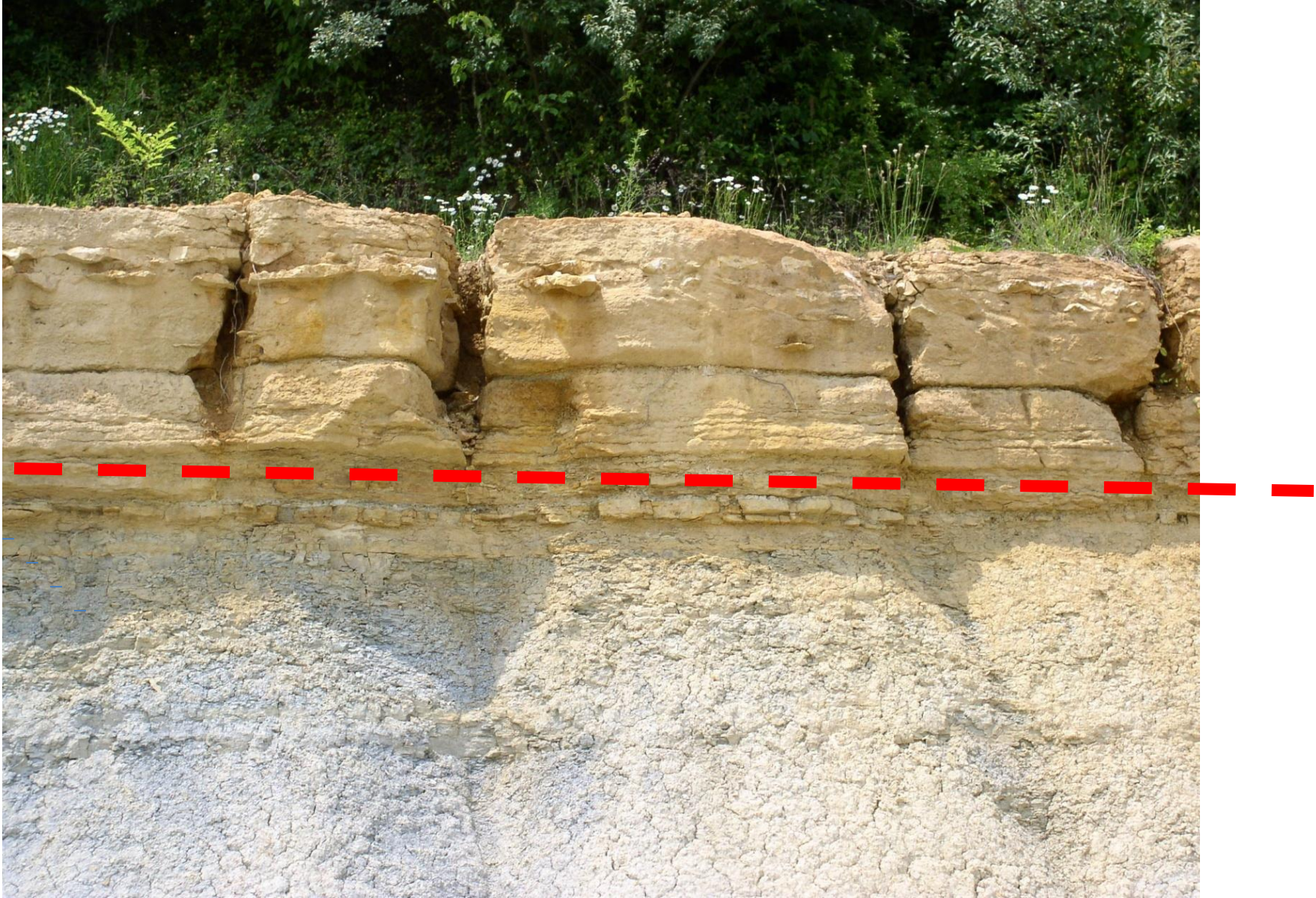


Swallow holes in new pond due to soil collapse into **cavities in the underlying Tanglewood.**

BATH CO., PERM BRASS / IMPERM PREACH

B
R
A
S
S

P
R
E
A
C
H



When ponds go bad: SCOTT CO., KY



Pond AWOL

Maury soil / Tanglewood limestone

Highly perm soil / permeable bedrock

CAN THIS LEAKER BE SALVAGED ?

Shelby County Pond

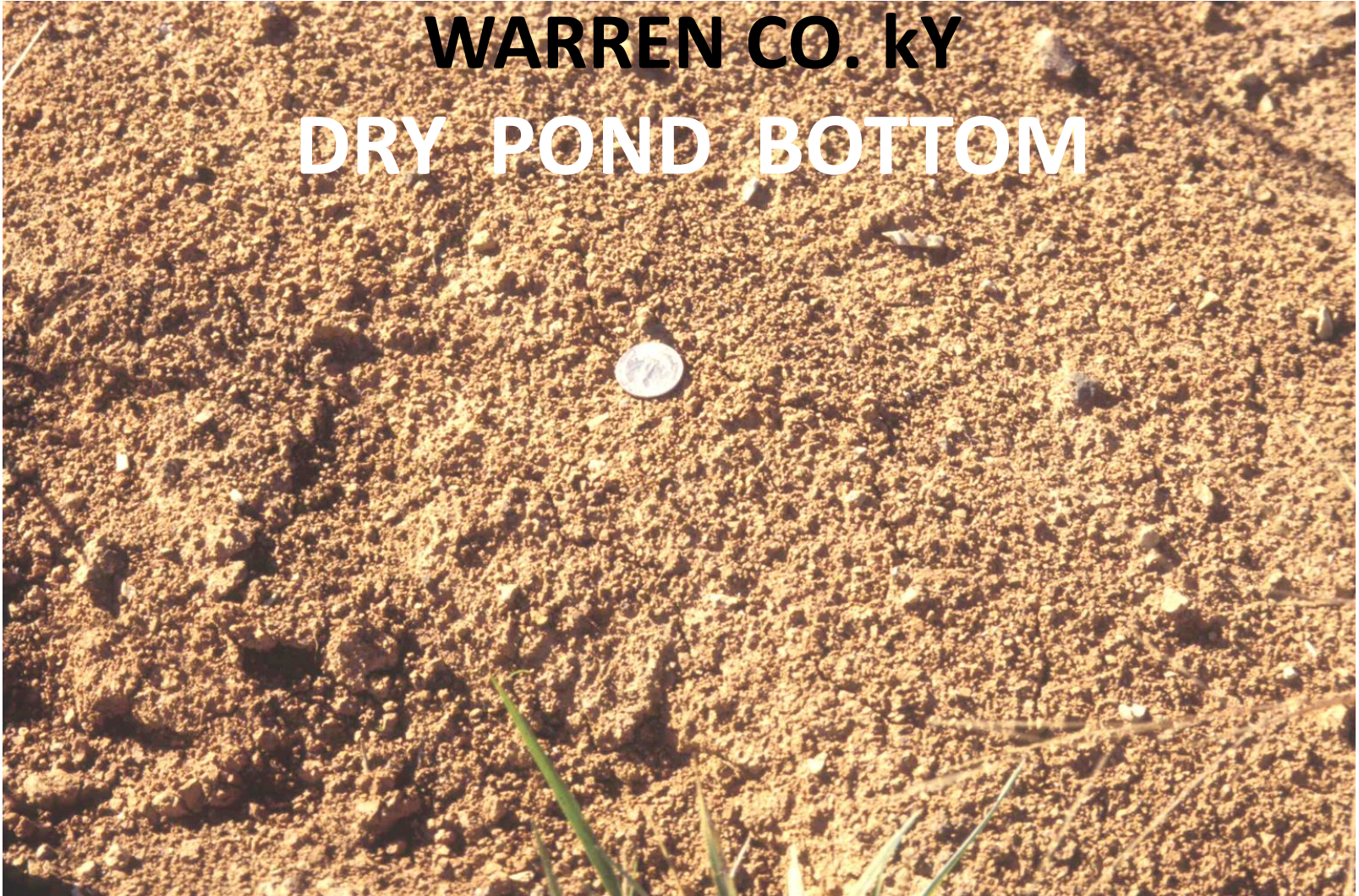


Leaks via macropores in **highly structured clayey soil**, over Calloway Creek Limestone.

What it looks like???

WARREN CO. KY

DRY POND BOTTOM




Highly structured clayey soil

Very permeable, very common

Salvaging a leaker.

Fayette County

A yellow bulldozer is shown in a field, equipped with a sheep's foot roller attachment. The machine is moving from right to left, leaving a trail of dark, clumpy soil behind it. In the background, there is a line of bare trees and a fence. The sky is overcast.

Using a sheep's foot roller to break down and compact highly structured clayey soil and reduce permeability. Creating a hydraulic barrier.

Mercer County Pond

Price \$1200



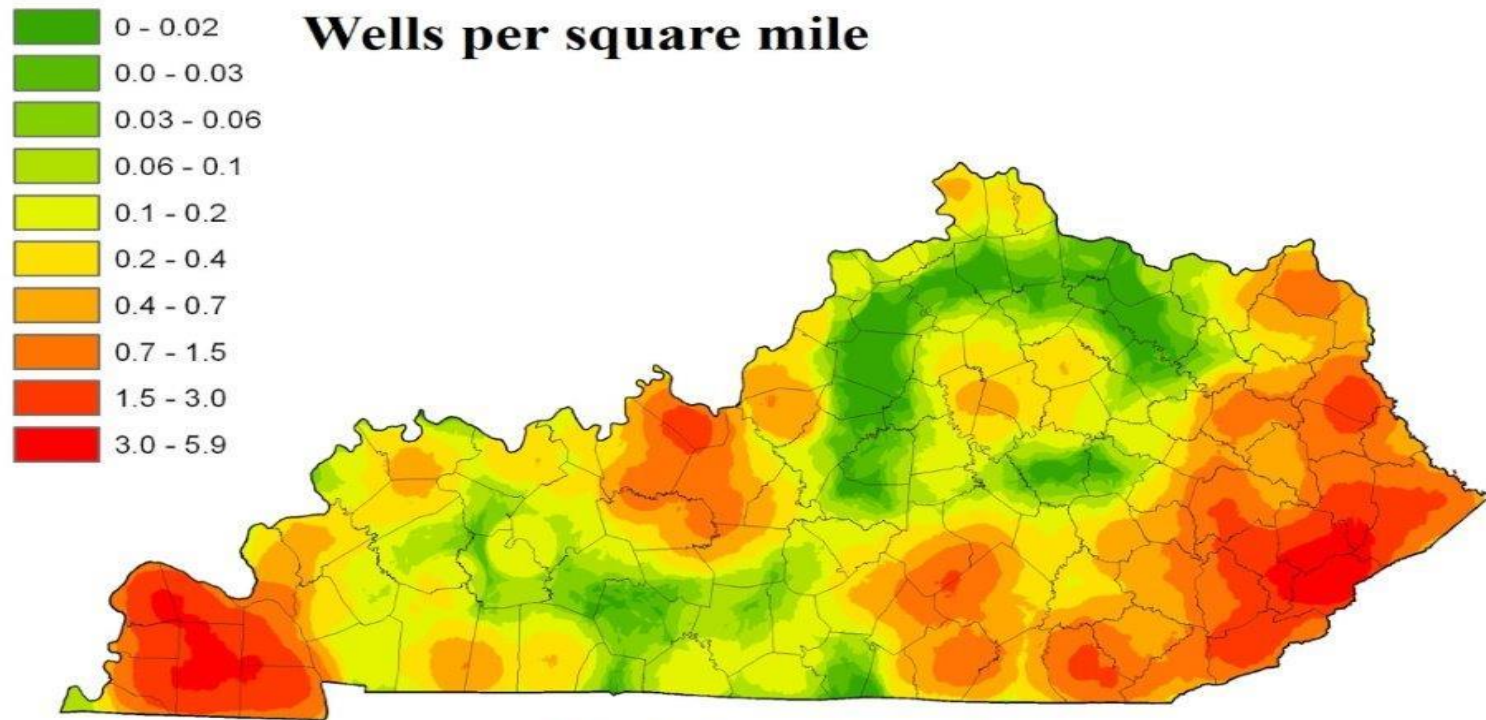
Sealed karst basin (sinkhole) with sheepfoot roller. Makes inexpensive pond.

FANCY FARMING



CATTLE IN PARADISE

So why don't we just drill a well? (From an unpublished KGS Study)



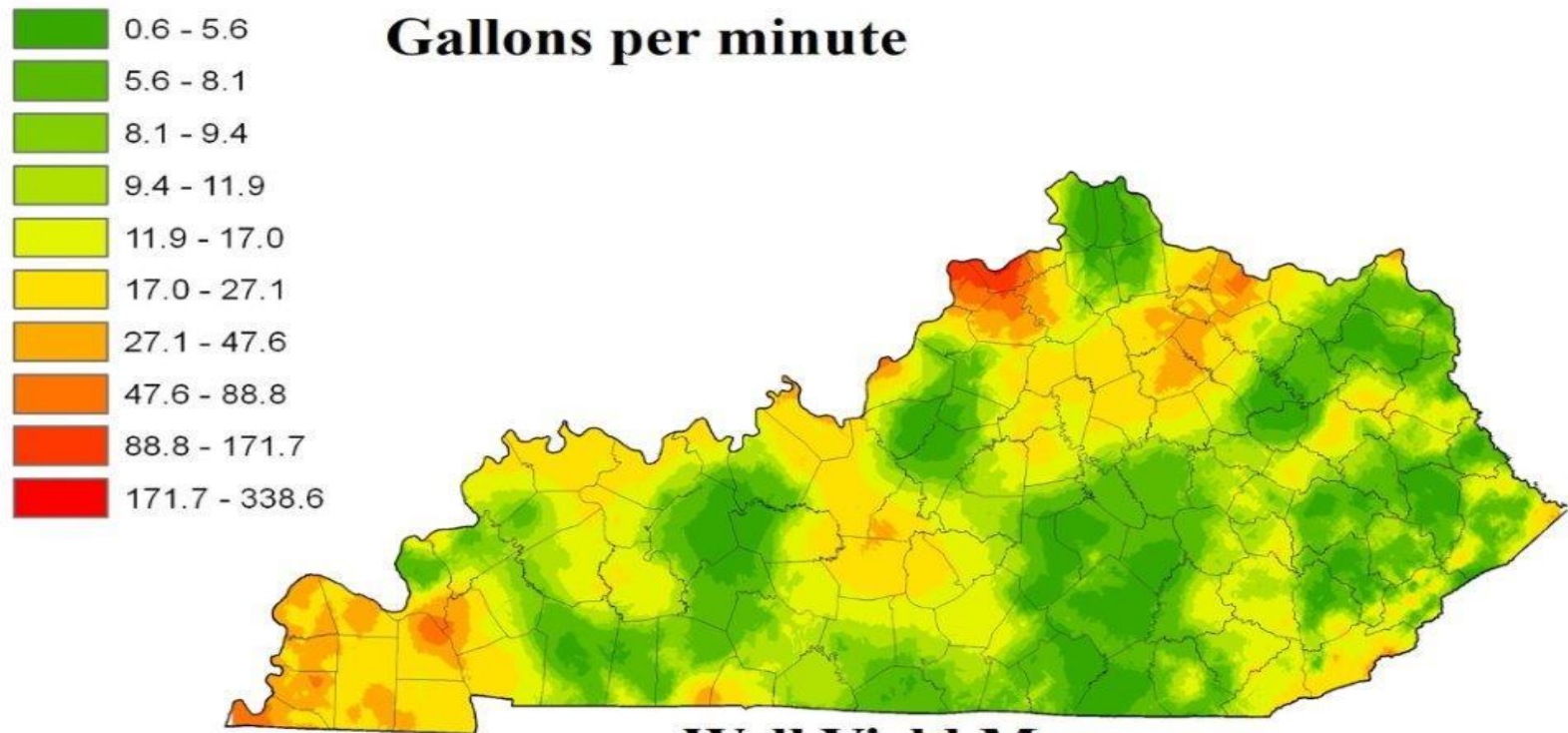
Well Density Map

Source: Kentucky Groundwater Data Repository, KGS
(Domestic, Public, Industrial wells)
Data vintage: 2011

So why don't we just drill a well?

- There are large portions of the state where the geology doesn't support well development.
- A useful well has to be drilled in a water producing zone/permeable bedrocks or sand/gravels.
- Wells in shale formations are almost always "dry holes".

So why don't we just drill a well? (From an unpublished KGS study)



Well Yield Map
(Taken by driller at time of completion)

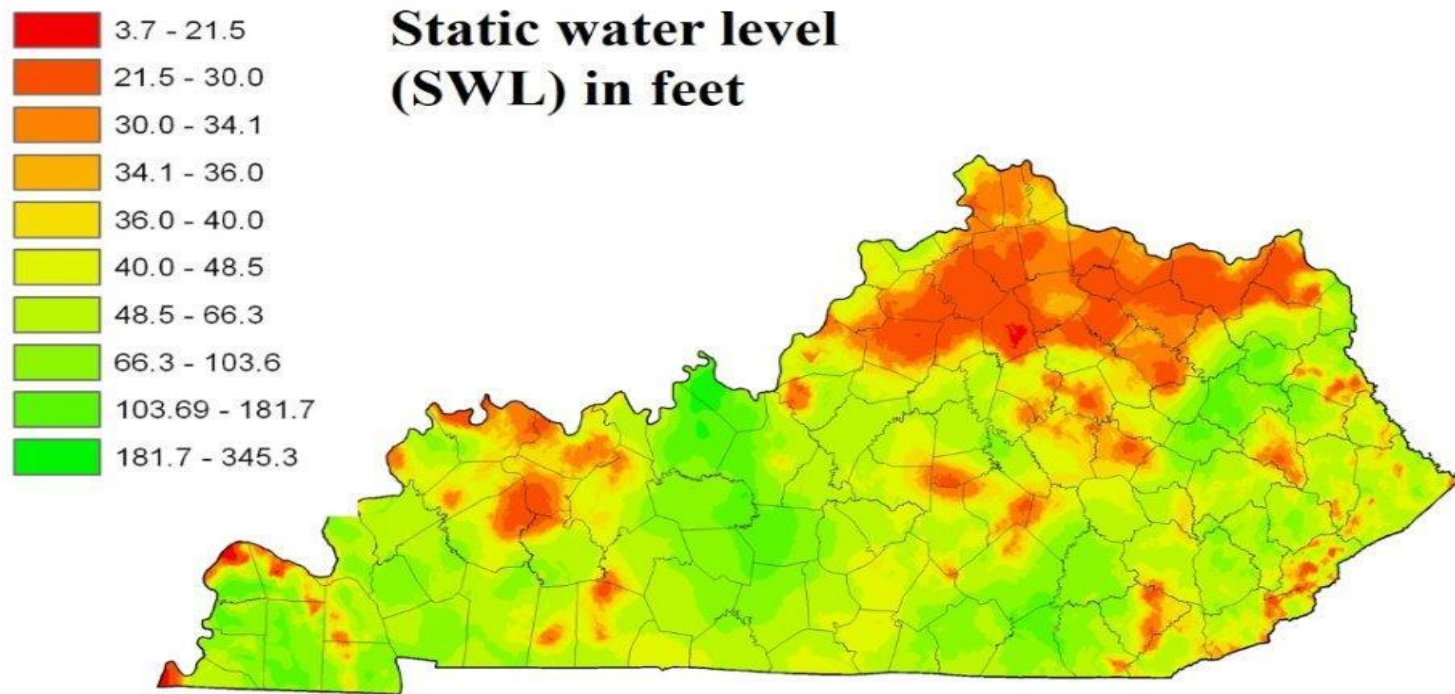
Source: Kentucky Groundwater Data Repository, KGS
(Yield data from KY Div. of Water via Certified Well Driller Program,
Domestic, Public, Industrial wells)
Data vintage: 2011

So why don't we just drill a well?

- Even in areas where wells can be developed, they are not always high producing.
- A well might initially look promising and then “play out”.
- The only way to know is a “pump out and recovery test” lasting 24 hours or more.

How deep to water?

(From an unpublished KGS study)



**Generalized Depth to Groundwater Map
(from SWL taken by driller at time of completion)**

Source: Kentucky Groundwater Data Repository, KGS
(SWL data from KY Div. of Water via Certified Well Driller Program,
Domestic, Public, Industrial wells)
Data vintage: 2011

Take away points:

- Pond work best where there are suitable soils and favorable (impermeable layer underneath) geology.
- Highly structured clay soils will “leak like a sieve” if they are not modified by mechanical means.
- Most producing wells are in limestones or “big river bottom” sands and gravels.

Take away points:

- It's possible to develop a well in shale if some fracturing is present.
- If there isn't any fracturing, most wells in shale formations will be "dry holes".
- Also, in some cases, ponds that shouldn't hold will, wells that shouldn't produce, do.
- And by the same token, some "slam dunk" ponds are dry, and so are some "slam dunk" wells.

Questions?

FINIS

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