Surficial Geology of Hoosick Falls, NY

with

Surficial Geologic Map at 1:12,000

and

Interpretive Cross Section through Village Well Field

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prepared under contract to

Hoosick Falls Central School District

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Purpose of Research

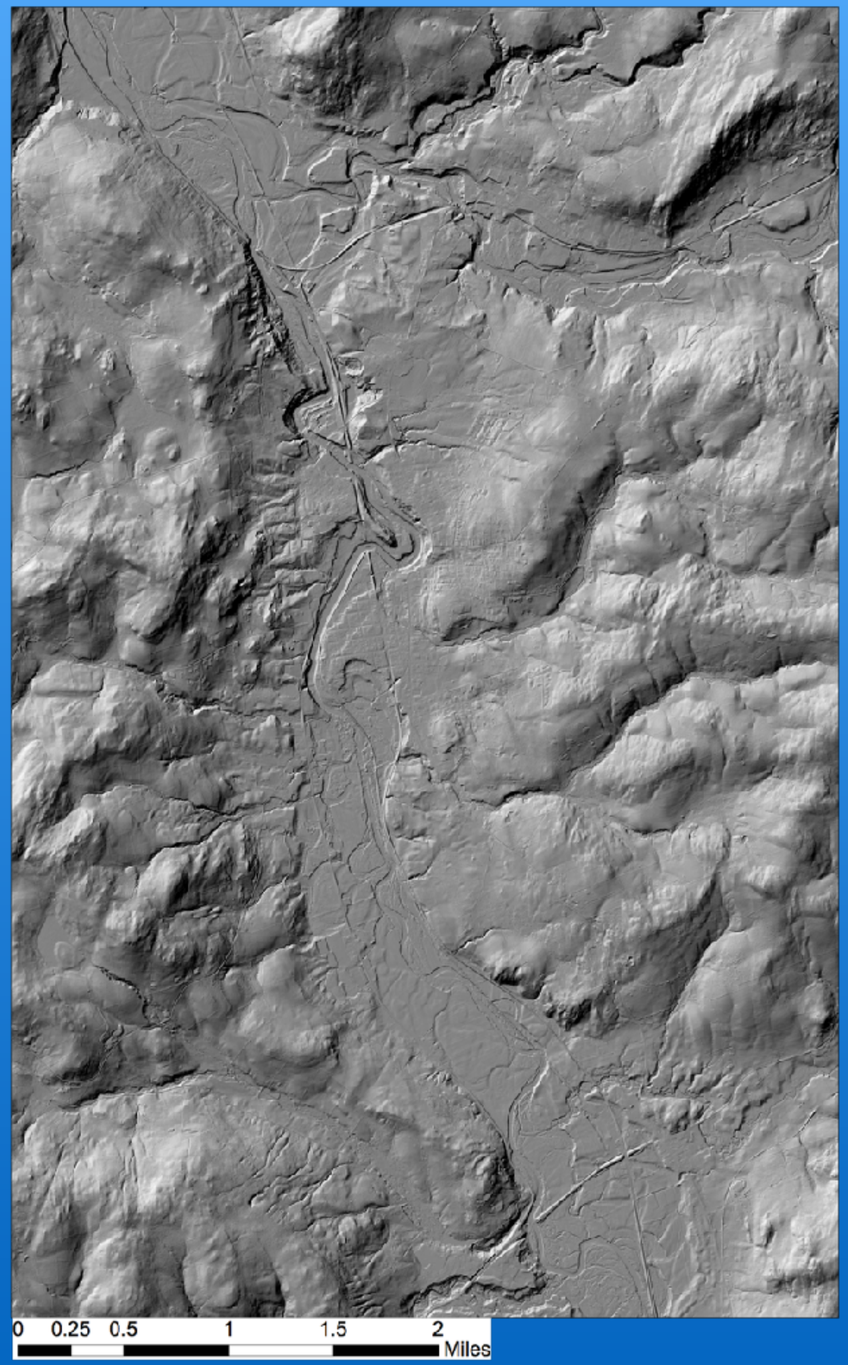
> Generate 1:12,000 surficial geologic map to assist with PFOA studies

> Analyze & interpret Village well field sediment facies

> Construct cross section through well field & Saint Gobain factory

> Identify aquifer prospects for new Village well

> Educational role for local students = use surficial geology to understand the Village unconsolidated aquifers



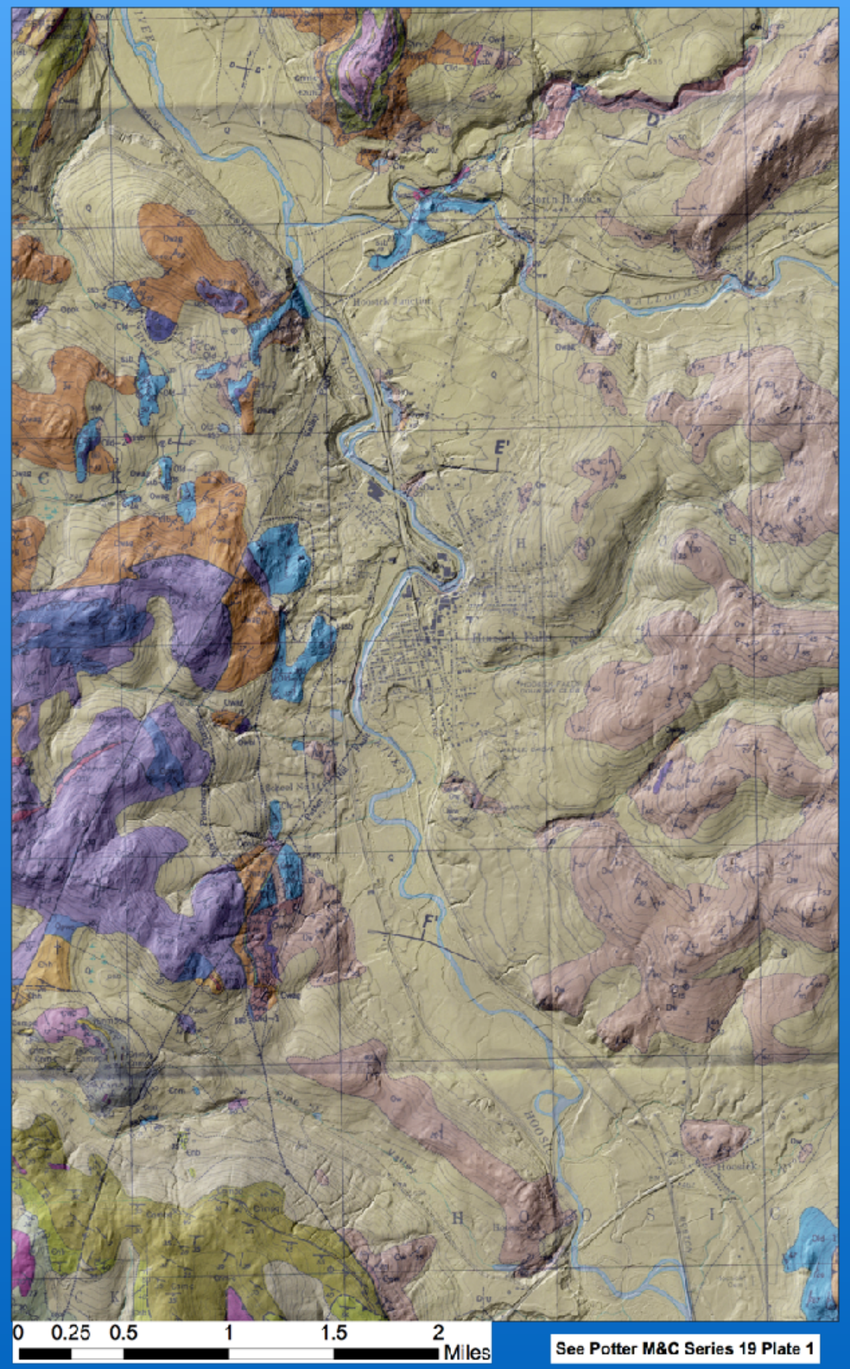
Elements of the Landscape

* Hoosic & Walloomsac rivers

* Taconic uplands

* Valley floor sediment
  - < glacial lake bottom
  - < fluvial terraces
  - < flood plain alluvium

(map from USGS)

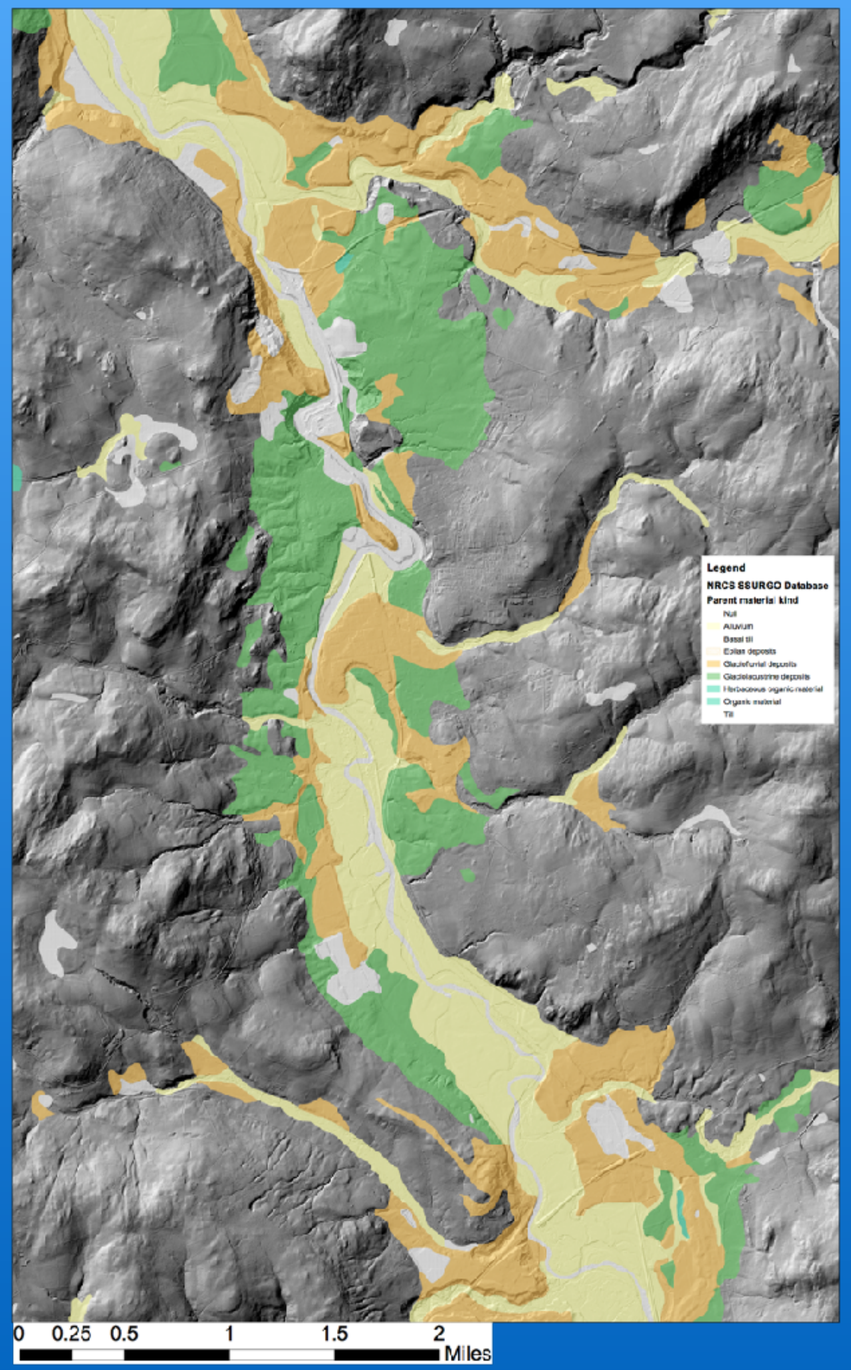


Bedrock Geology (Potter's map)

* Predominantly fine grained rock - shale/slate of Walloomsac & Nassau Formations

* SW corner is Rensselaer Graywacke

* Minor valley limestones shown in blue



Soils Map Distilled for Materials

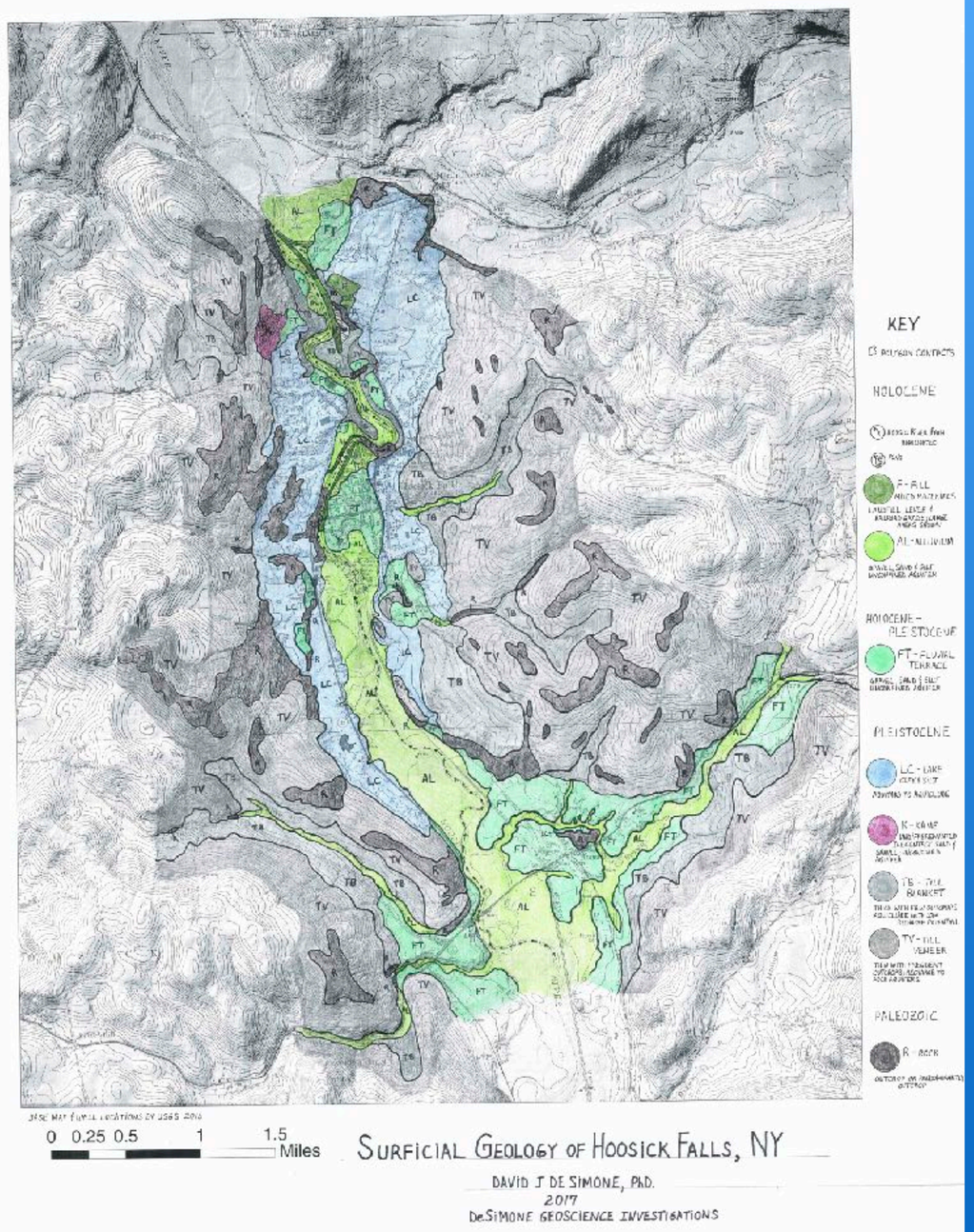
* Till uplands - gray & white

* Glaciolacustrine - green

* Glaciofluvial - orange

* Alluvium - yellow

(map from USGS)



Surficial Geology Map 2017

Map units:

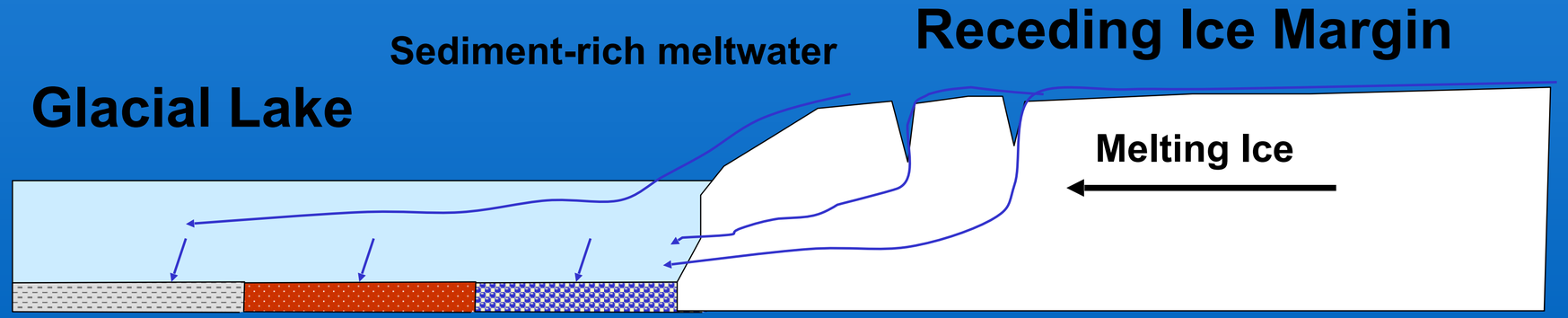
* Outcrops - darkest gray
* Till - thick or thin - grays
* Ice contact SG - purple
* Lake silt-clay - blue
* Fluvial terraces - green
* Floodplain alluvium - yellow

Who wants to digitize this? See me!

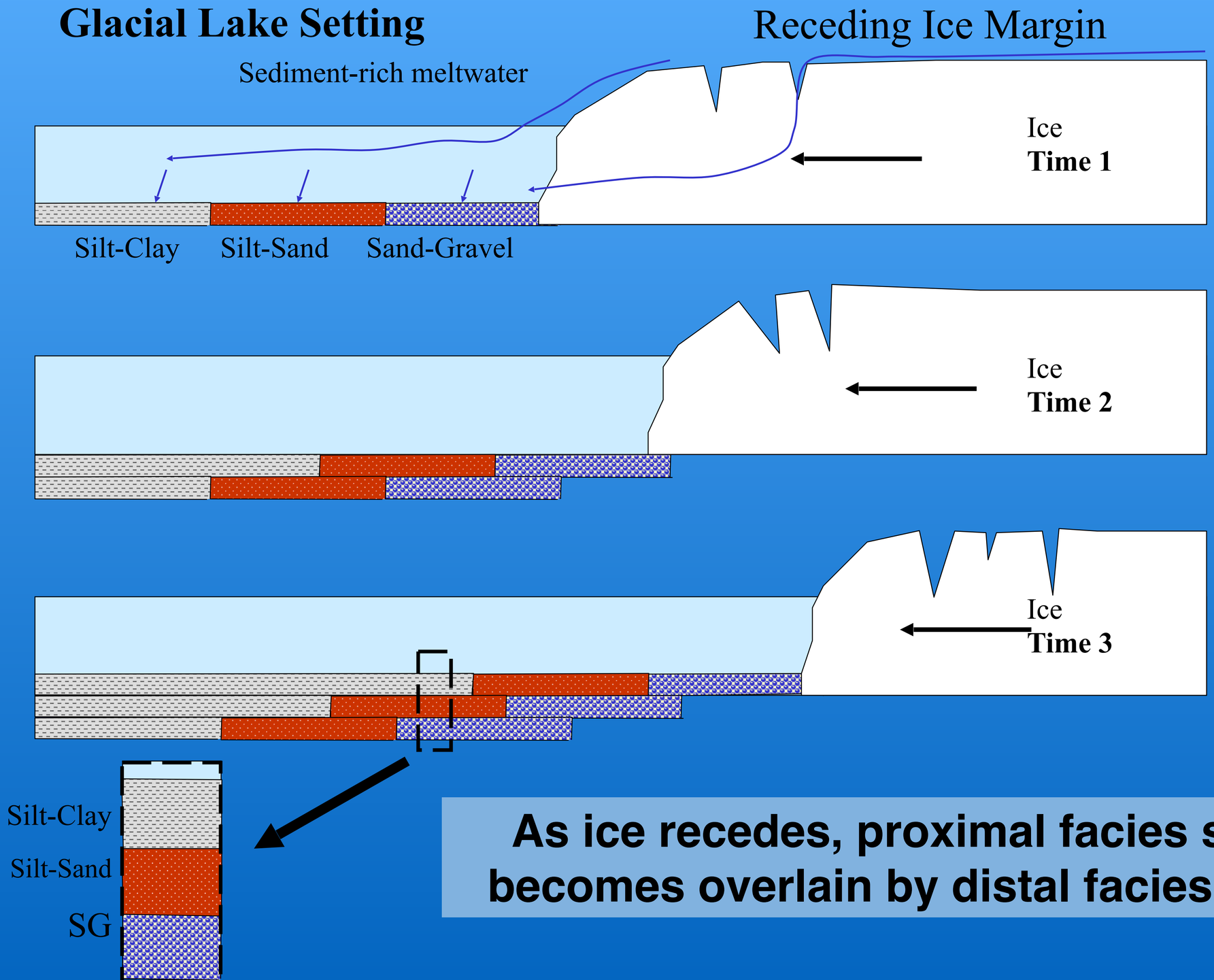

Glacial Lake Bascom & Hoosick Falls ca 13,500 years ago.
Okay, be imaginative !

Glaciolacustrine Sediments

- glaciolacustrine silt-clay - settling out of very fine particles distant from the glacier - distal - and in deep water
  - Slow settling - Stokes Law…clay takes forever!
  - $K = 10^{-5}$ to 10^{-8} cm/s = AQUICLUDE or AQUITARD
- sand-gravel - proximal to glacier, short transport distance, typically derived from subglacial stream or lateral meltwater stream
  - Fast settling
  - $K = 10^{-4}$ or better! = AQUIFER (confined or unconfined)



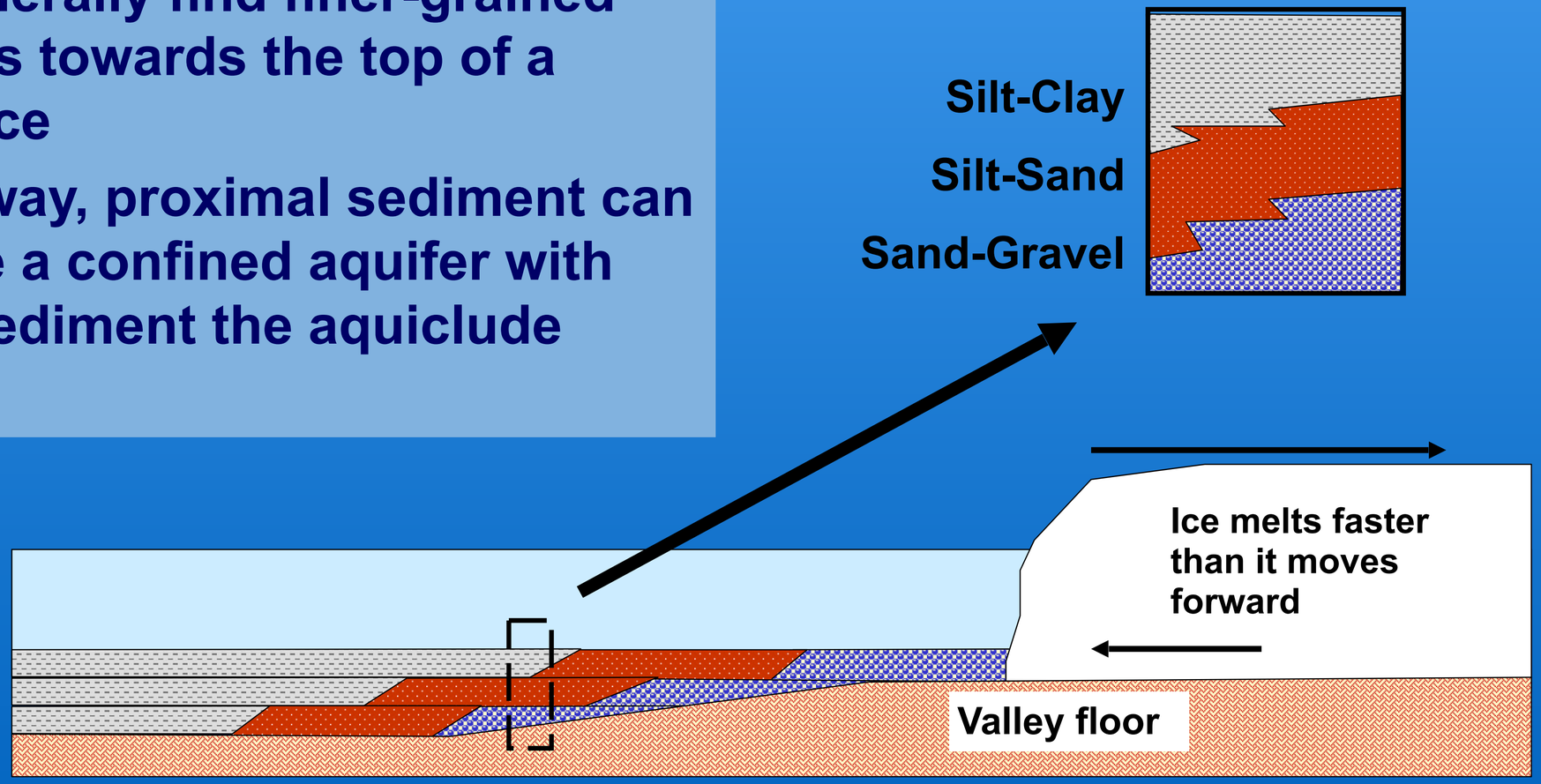
Glacial Lake Setting



As ice recedes, proximal facies sediment becomes overlain by distal facies sediment

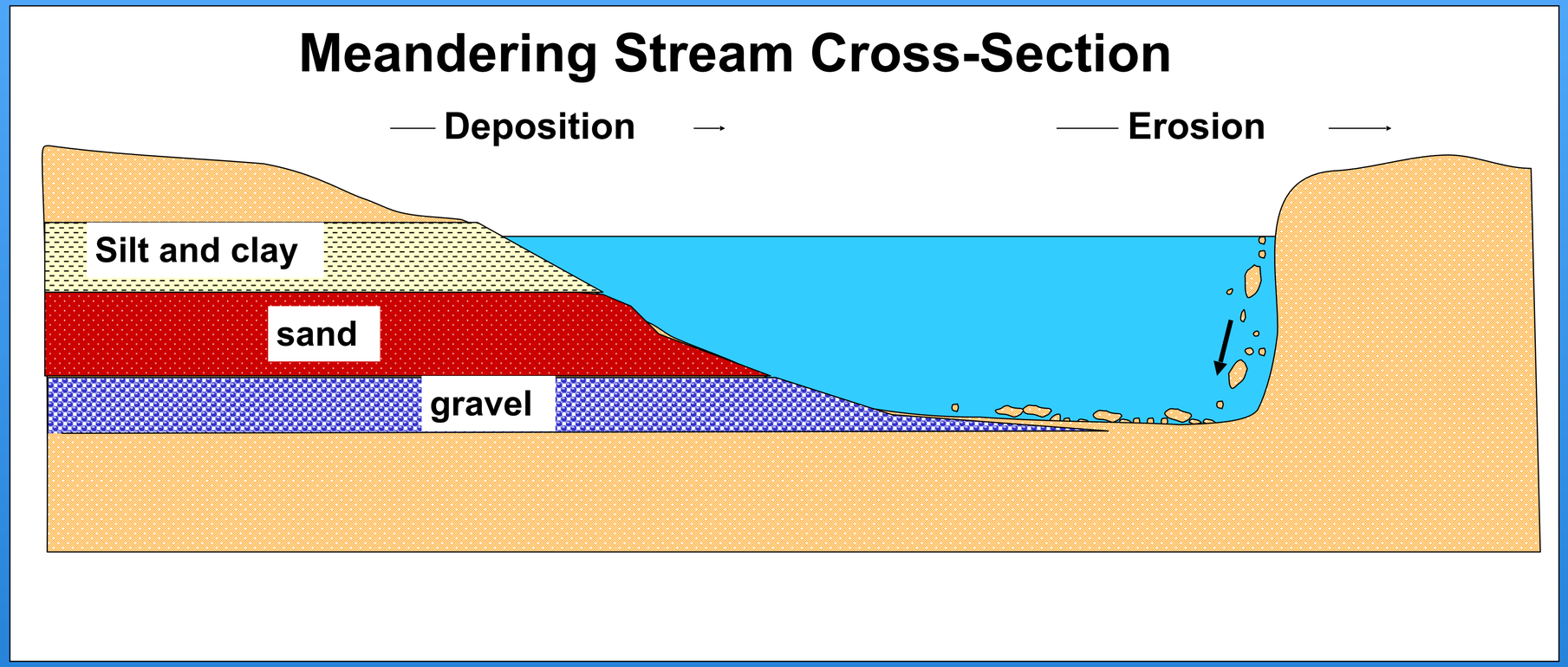
Glaciolacustrine Stratigraphy

- As glaciers retreat, the dominant source of sediment in a glacial lake moves farther away
- You generally find finer-grained deposits towards the top of a sequence
- In this way, proximal sediment can become a confined aquifer with distal sediment the aquiclude



Glacial Lake Bascom varves near NAPA store

Subaqueous fan with overlying alluvial fan in Petersburg.
Possible recharge to deep confined aquifer but not present in Hoosick Falls.



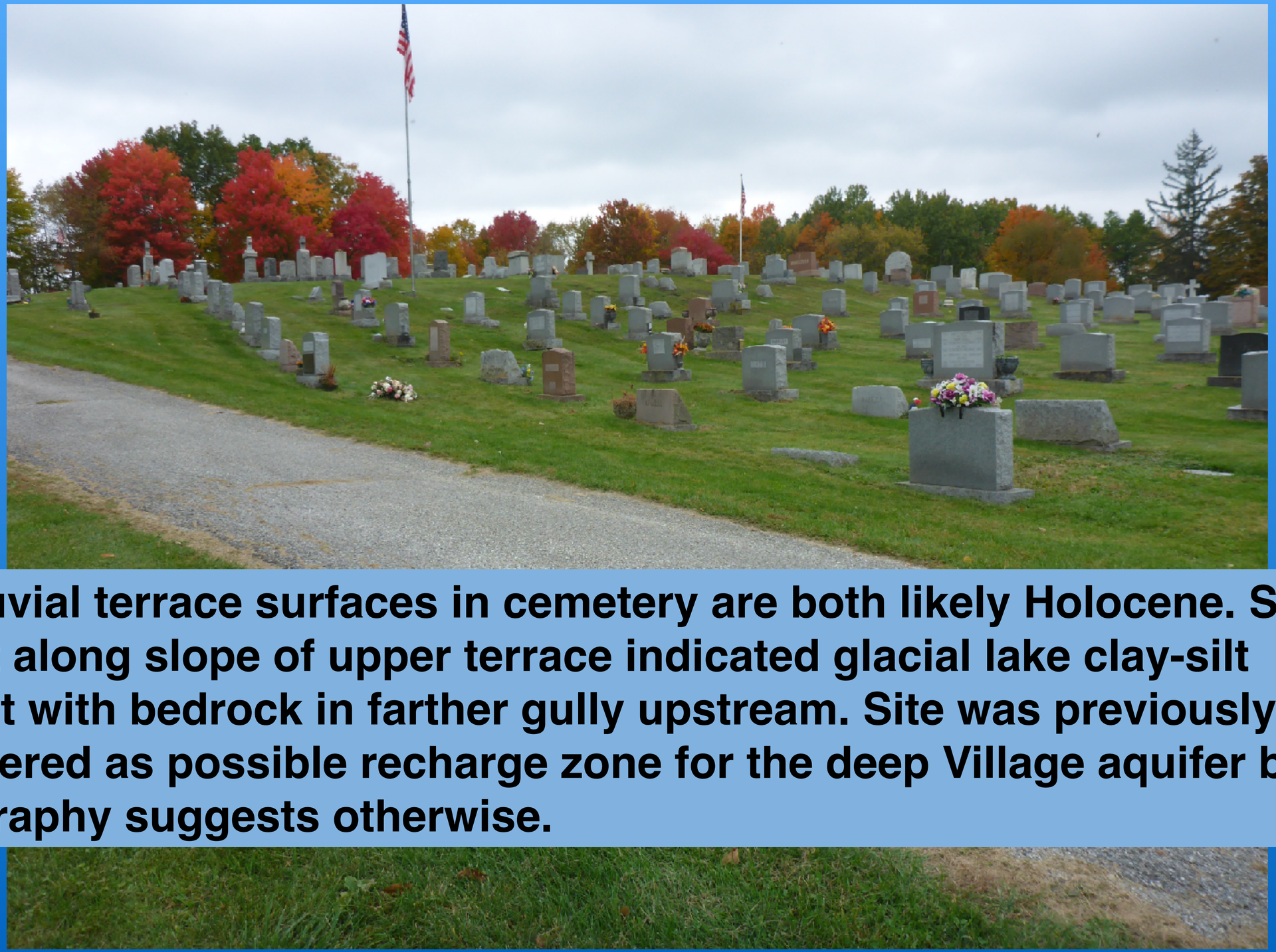
Alluvium - Fluvial Terrace Package - Unconfined Aquifer

* Channel bottom deposits are coarsest (highest *K*), topped by sands, silts and clays (decreasing *K*'s)
…a <u>Fining Upwards Sequence</u>

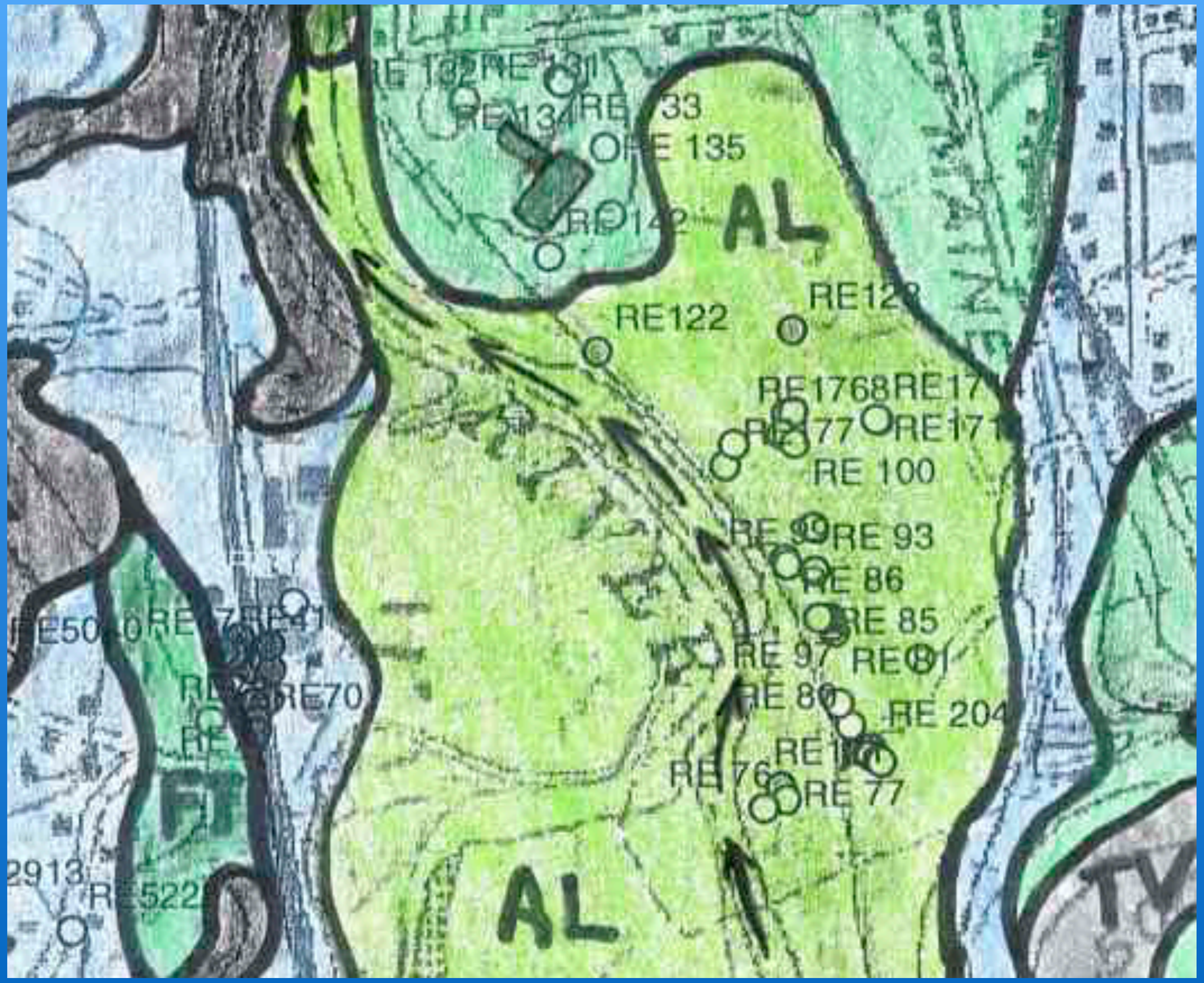
* Typically 1-5m thick and truncate sediment below

Fluvial Terrace

Contact exposed north of Seifert's Auction House. Glacial Lake Bascom rhythmites at base are truncated and overlain by fluvial terrace pebble gravel. Bascom lacustrines are Upper Pleistocene while terrace gravels are likely Holocene.



Two fluvial terrace surfaces in cemetery are both likely Holocene. Shovel test pit along slope of upper terrace indicated glacial lake clay-silt present with bedrock in farther gully upstream. Site was previously considered as possible recharge zone for the deep Village aquifer but this stratigraphy suggests otherwise.



Well field and Saint Gobain Surficial Geology Detail

> Factory on fluvial terrace

> Well field on flood plain

> No obvious recharge area to deep overburden aquifer

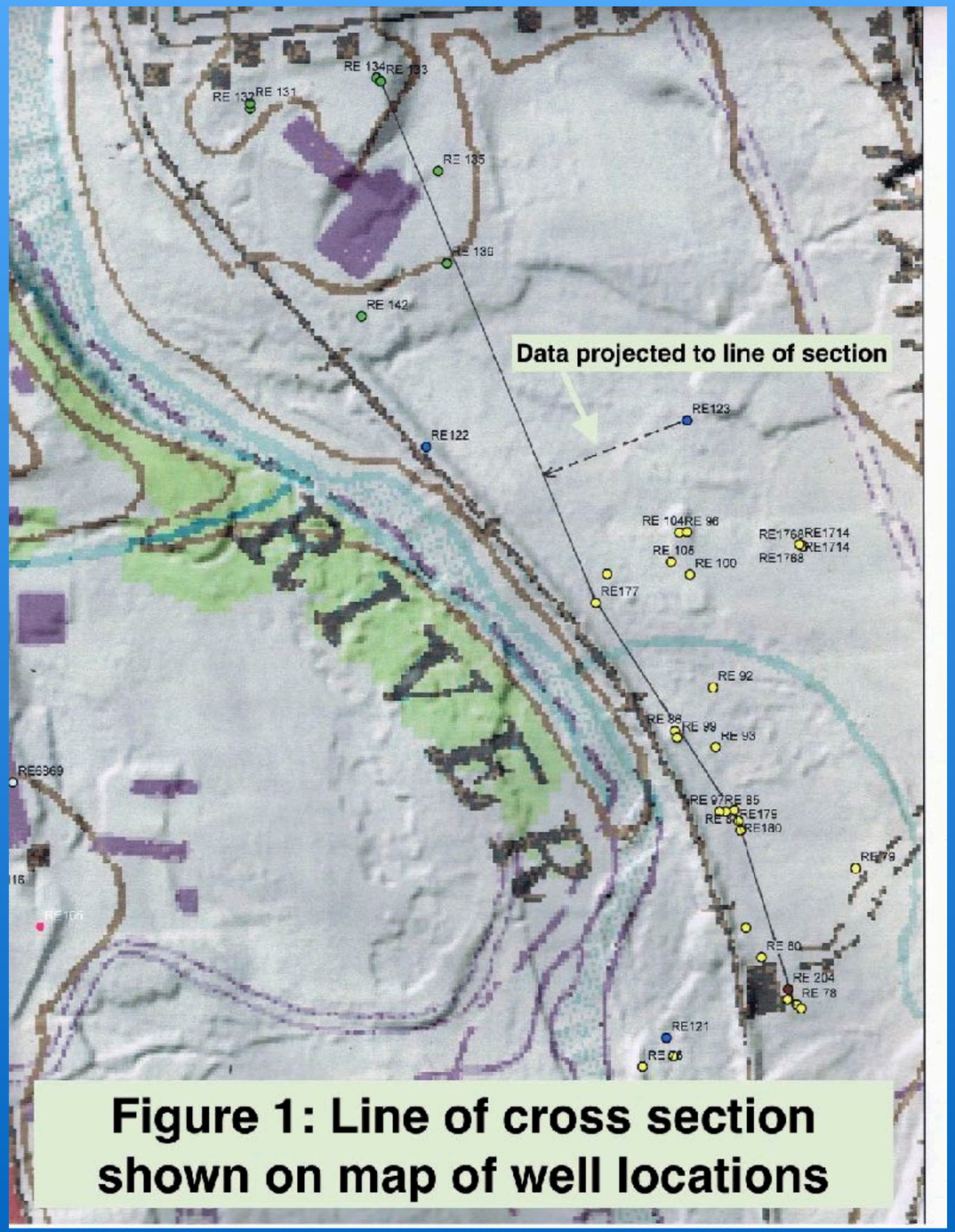


Figure 1: Line of cross section shown on map of well locations

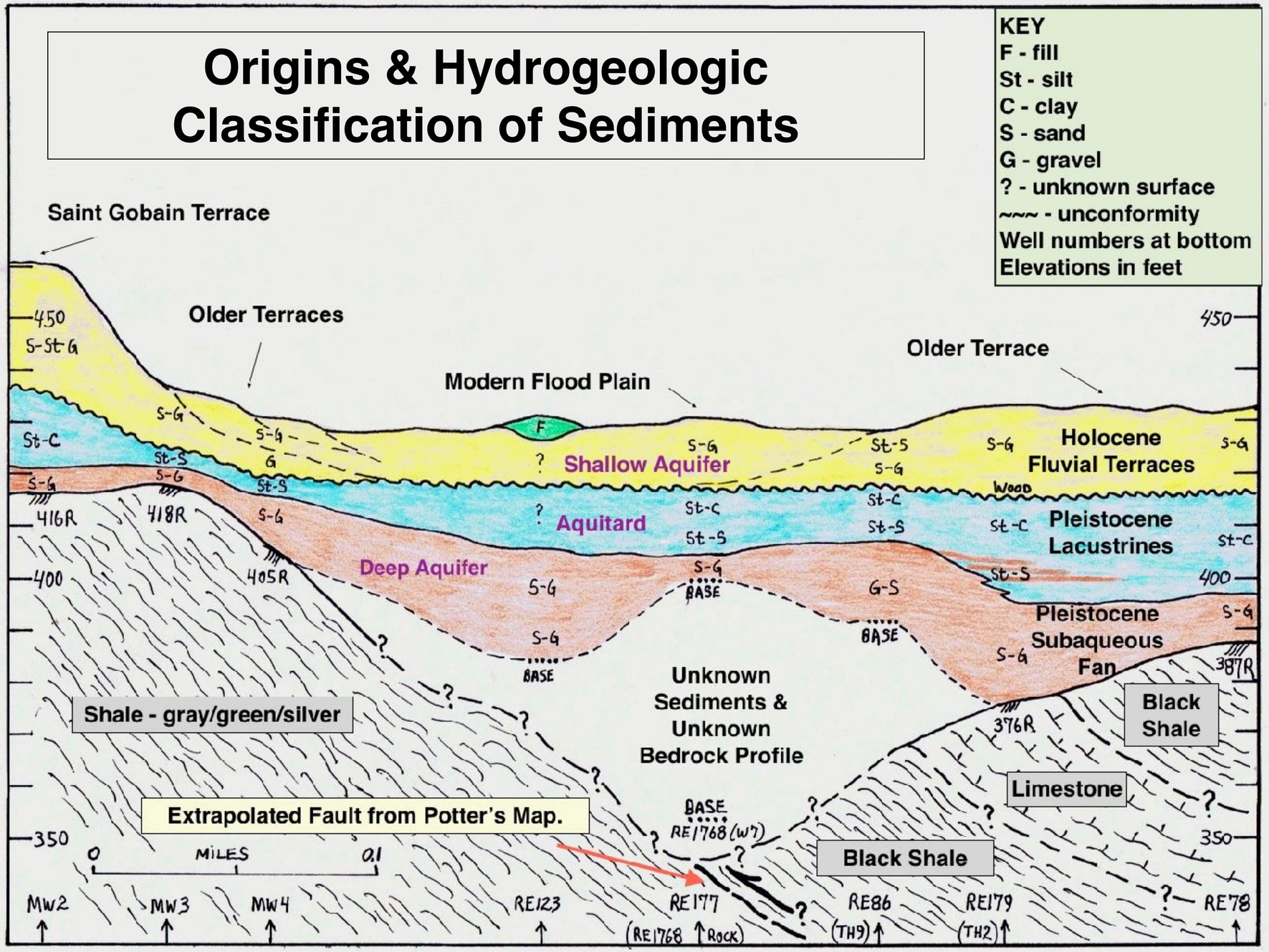
Cross Section

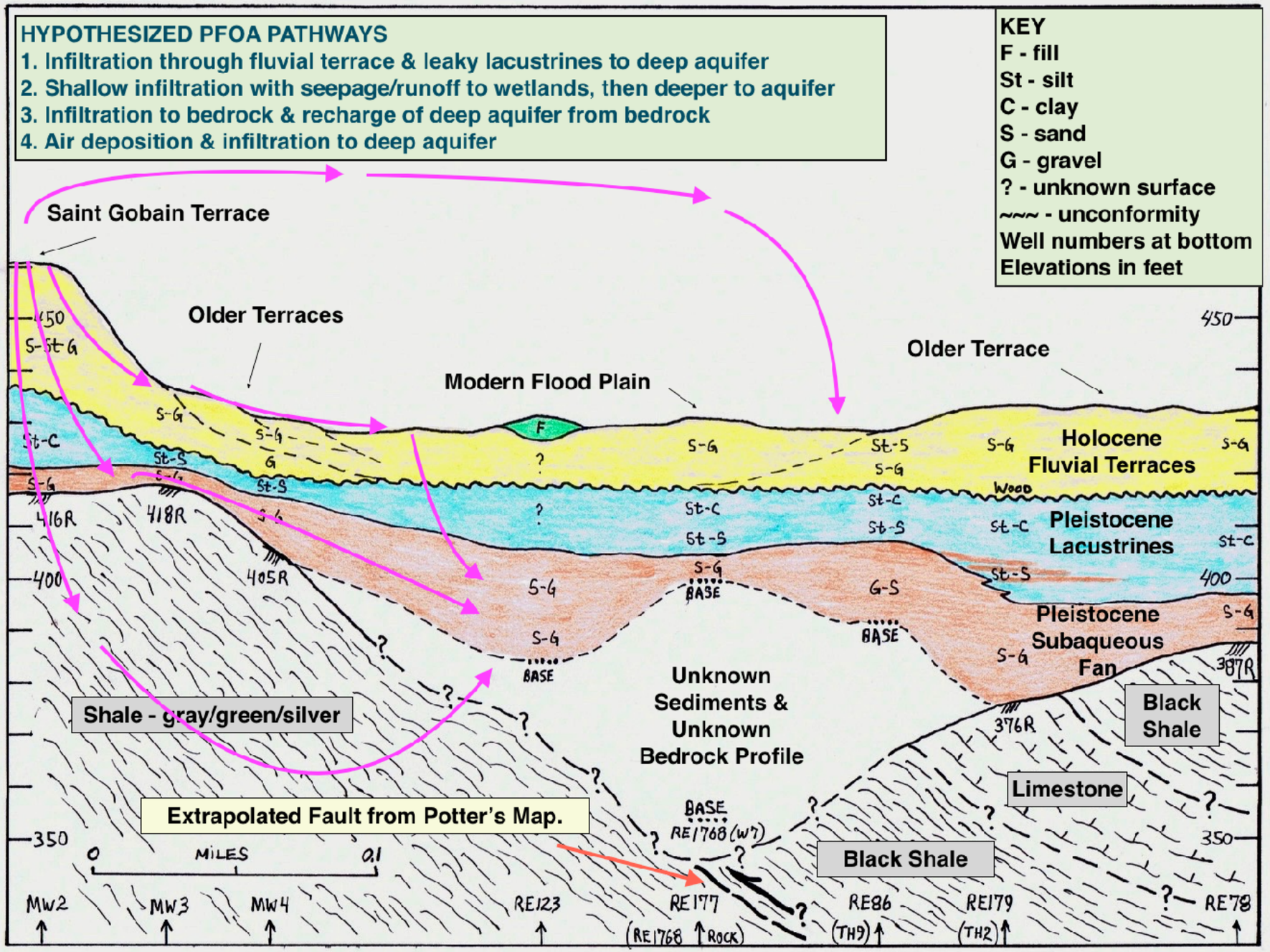
*Saint Gobain through well field

*What's the stratigraphy & origin of the sediments that comprise the village aquifer & adjacent units?

Map courtesy of USGS

Origins & Hydrogeologic Classification of Sediments




HYPOTHESIZED PFOA PATHWAYS
1. Infiltration through fluvial terrace & leaky lacustrines to deep aquifer
2. Shallow infiltration with seepage/runoff to wetlands, then deeper to aquifer
3. Infiltration to bedrock & recharge of deep aquifer from bedrock
4. Air deposition & infiltration to deep aquifer
KEY
F - fill
St - silt
C - clay
S - sand
G - gravel
? - unknown surface
~~~ - unconformity
Well numbers at bottom
Elevations in feet
Saint Gobain Terrace
Older Terraces
Modern Flood Plain
Older Terrace
Holocene Fluvial Terraces
Pleistocene Lacustrines
Pleistocene Subaqueous Fan
Unknown Sediments & Unknown Bedrock Profile
Shale - gray/green/silver
Extrapolated Fault from Potter's Map.
Black Shale
Limestone
Black Shale
Wood
BASE
416R
418R
405R
387R
376R
450
400
350
0
MILES
0.1
MW2
MW3
MW4
RE123
RE177
(RE1768 ROCK)
RE1768 (W7)
RE86
(TH9)
RE179
(TH2)
RE78
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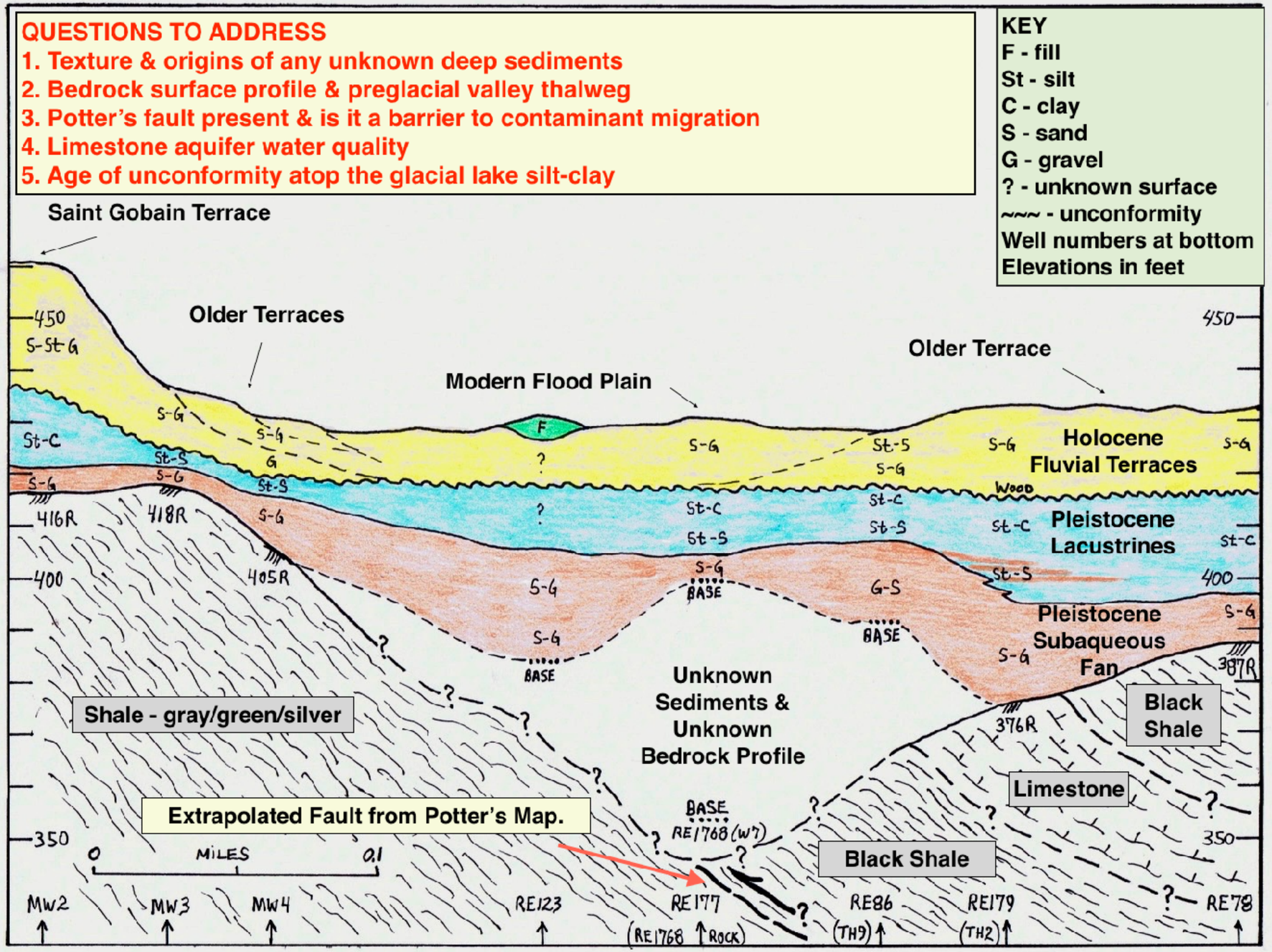
QUESTIONS TO ADDRESS
1. Texture & origins of any unknown deep sediments
2. Bedrock surface profile & preglacial valley thalweg
3. Potter's fault present & is it a barrier to contaminant migration
4. Limestone aquifer water quality
5. Age of unconformity atop the glacial lake silt-clay
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Why did the confining silt-clay layer become semi-confining?

> Glacial history matters! Facies matter !

*** Ice recession to the site of Hoosick Falls was accompanied by rapid drop of Lake Bascom from 900ft Potter Hill level through 700ft, 665ft, 625ft short-lived levels controlled by bedrock thresholds (DeSimone & Dethier, 1992; Saffer & Madera, 1994, 1995) & finally to 520ft controlled by ice effectively ending the lake.**

> The lake became very shallow very quickly and fine sand replaced deepwater silt-clay deposition.

Conclusions or Questions That Remain?

> Questions originally posed in January 2017 been answered by all of the reports you've heard today?

* Pathways of PFOA migration evaluated?
* Bedrock profile & lithologies/structures known?
* Bedrock aquifer contaminated?

> Source(s) of PFOA in wells located some distance from factories understood?

> Are there better aquifer prospects farther south than studied to date even if they have logistical issues?