Understanding Uranium in Groundwater Wells in Glastonbury, CT

Wendy Mis, M.P.H., Dir. of Health, Town of Glastonbury
Don Kendrick, M.S., Sanitarian, Town of Glastonbury
Rachel Coyte, Ph.D., Duke University
Hari Kandel, Ph.D., Lake Superior State University
Caitlyn Hall, Ph.D., University of Arizona

AGU THRIVING EARTH EXCHANGE

The Team

Glastonbury Town Staff

Richard Johnson
Town Manager

Wendy Mis
Dir. of Health

Don Kendrick
Sanitation Engineer

Kathryn Paquette
Comm. Manager

Subject Matter Experts

Dr. Rachel Coyte
Ohio State U.

Dr. Hari Kandel
Lake Superior State U.

Thriving Earth Exchange Project Facilitator

Dr. Caitlyn Hall
U. of Arizona

Fall 2019

Project Team and Scope Established

Caitlyn (Thriving Earth Exchange) brought in

Project scope outlined to understand uranium levels in drinking well water

Rachel and Hari are brought in as subject matter experts

2020

Initial Research Completed

Gathered beginning water quality data

Completed beginning geographical and geological data analysis

COVID Pause

Spring 2021

Research Restarts

Connected with Wake County (also experiencing uranium contamination) to share information and actions

Gathered remaining data sets

Drew connections to GIS, water quality, well characteristics

Completed report!

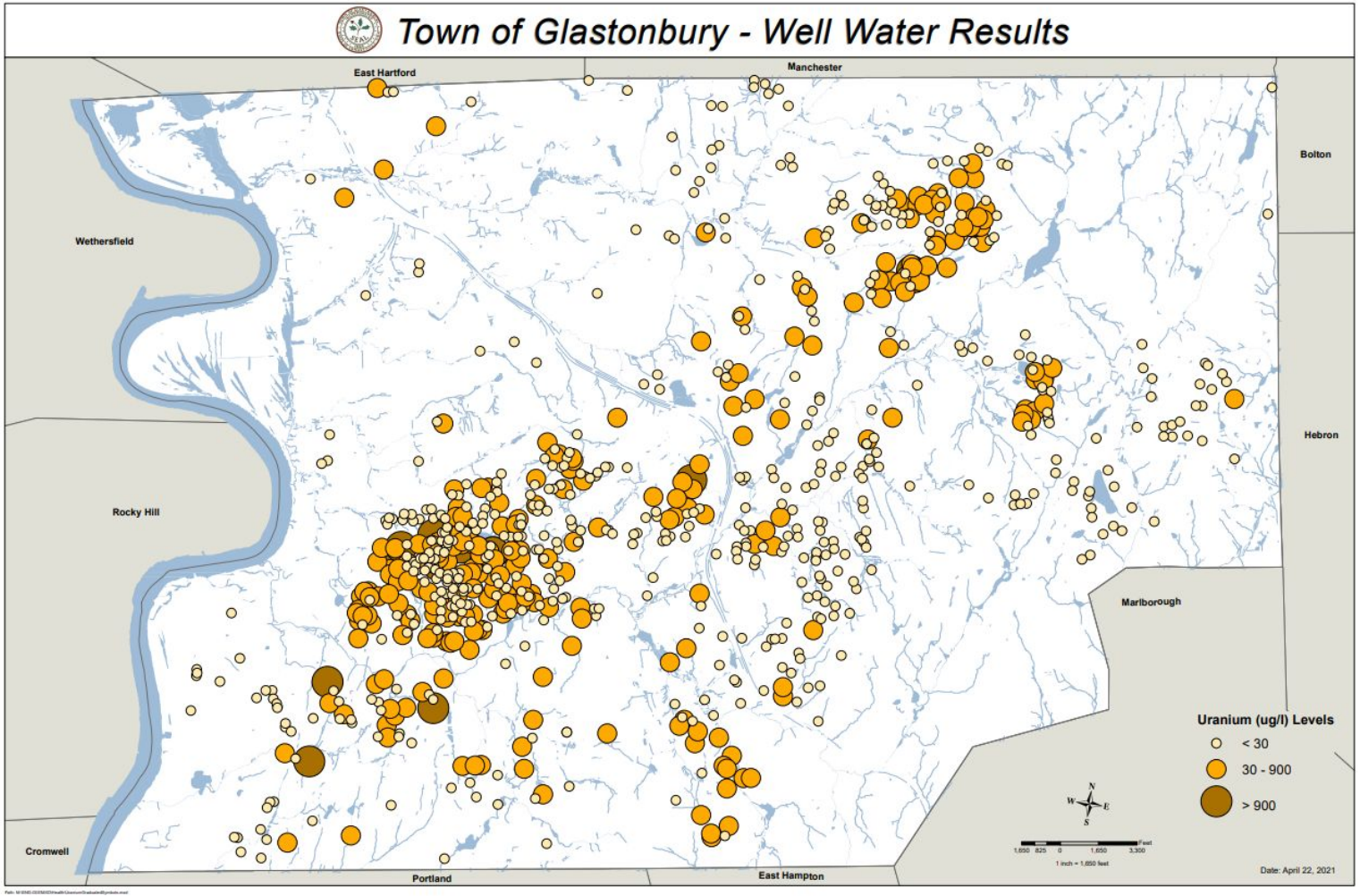
Fall 2021 to Now

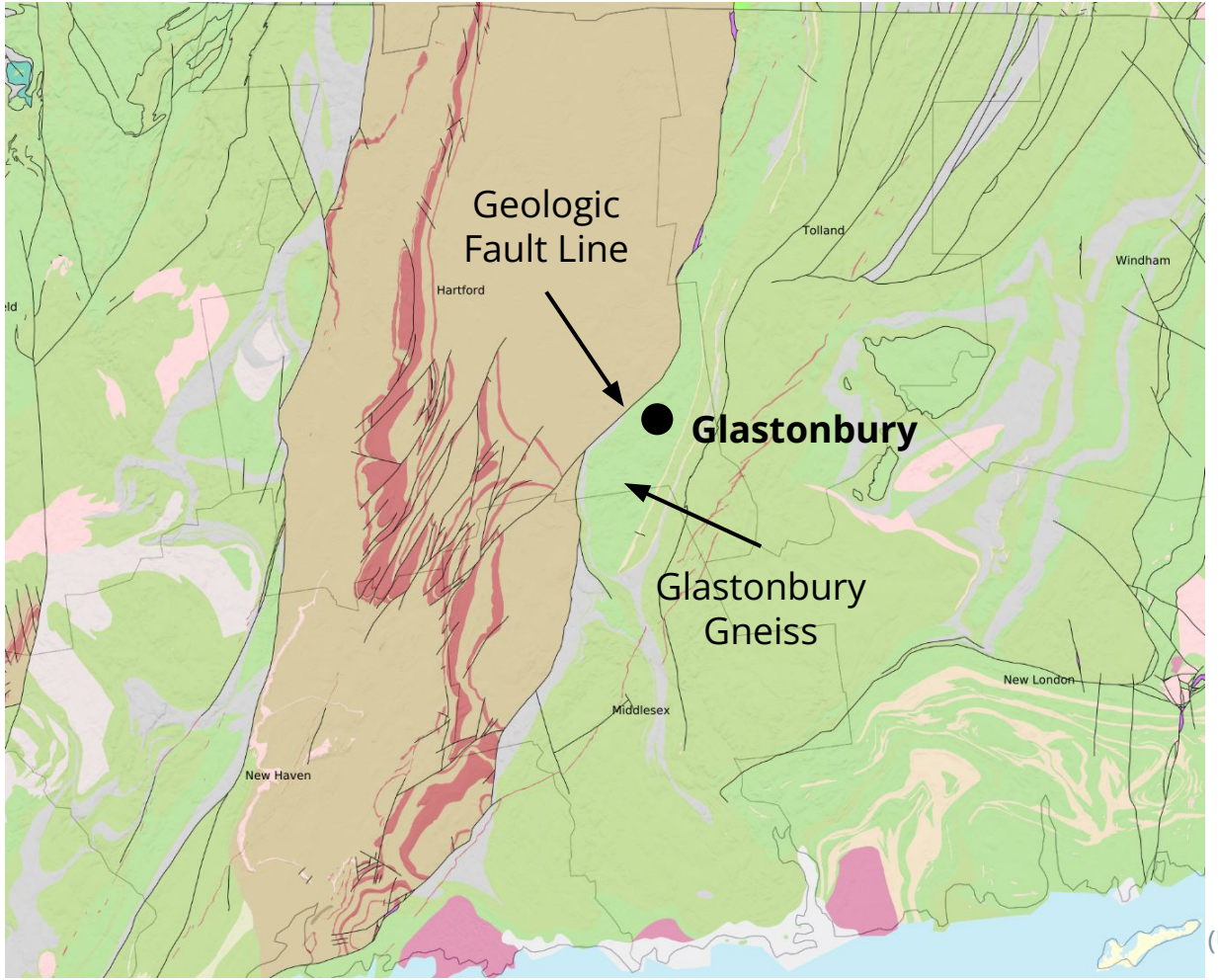
Research Guides Next Action Steps

Lay out steps for citizens impacted

Working with Tighe & Bond to develop public water service extension

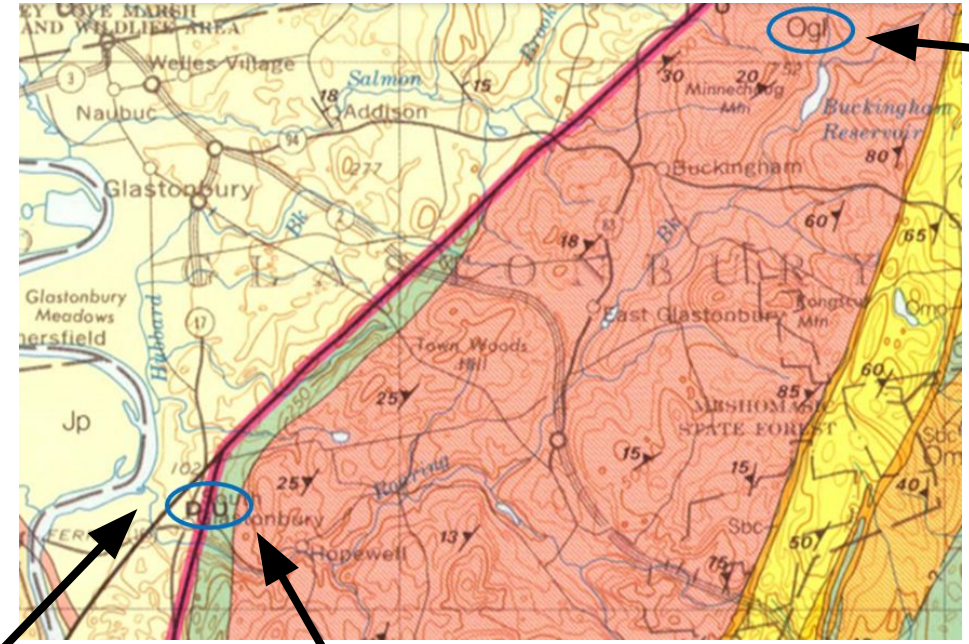
Looking at funding opportunities to ease costs to individuals


Town of Glastonbury - Well Water Results
East Hartford
Manchester
Bolton
Wethersfield
Hebron
Rocky Hill
Marlborough
Cromwell
Portland
East Hampton
Uranium (ug/l) Levels
< 30
30 - 900
> 900
N
W
E
S
1,650 825 0 1,650 3,300
Feet
1 inch = 1,650 feet
Date: April 22, 2021



(USGS Mineral Resources On-Line Spatial Data)

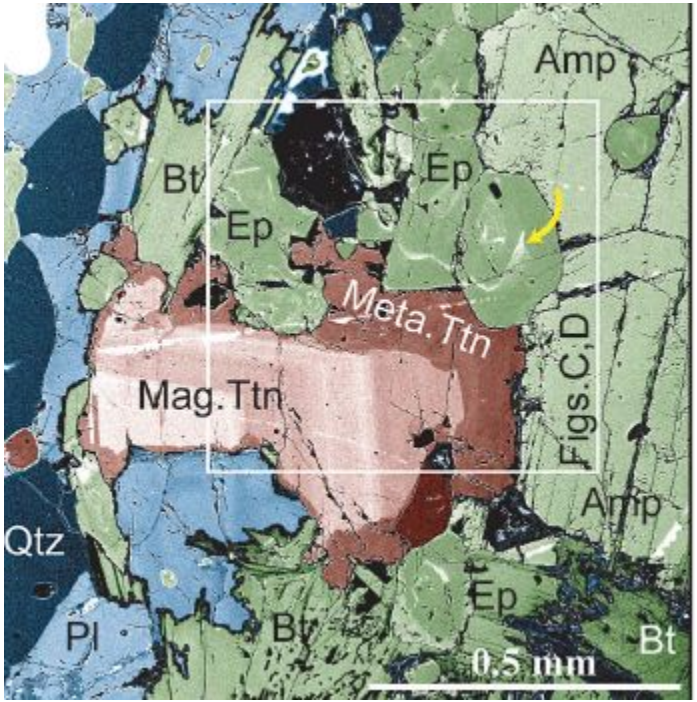
Geology Under Glastonbury: Zoomed Out



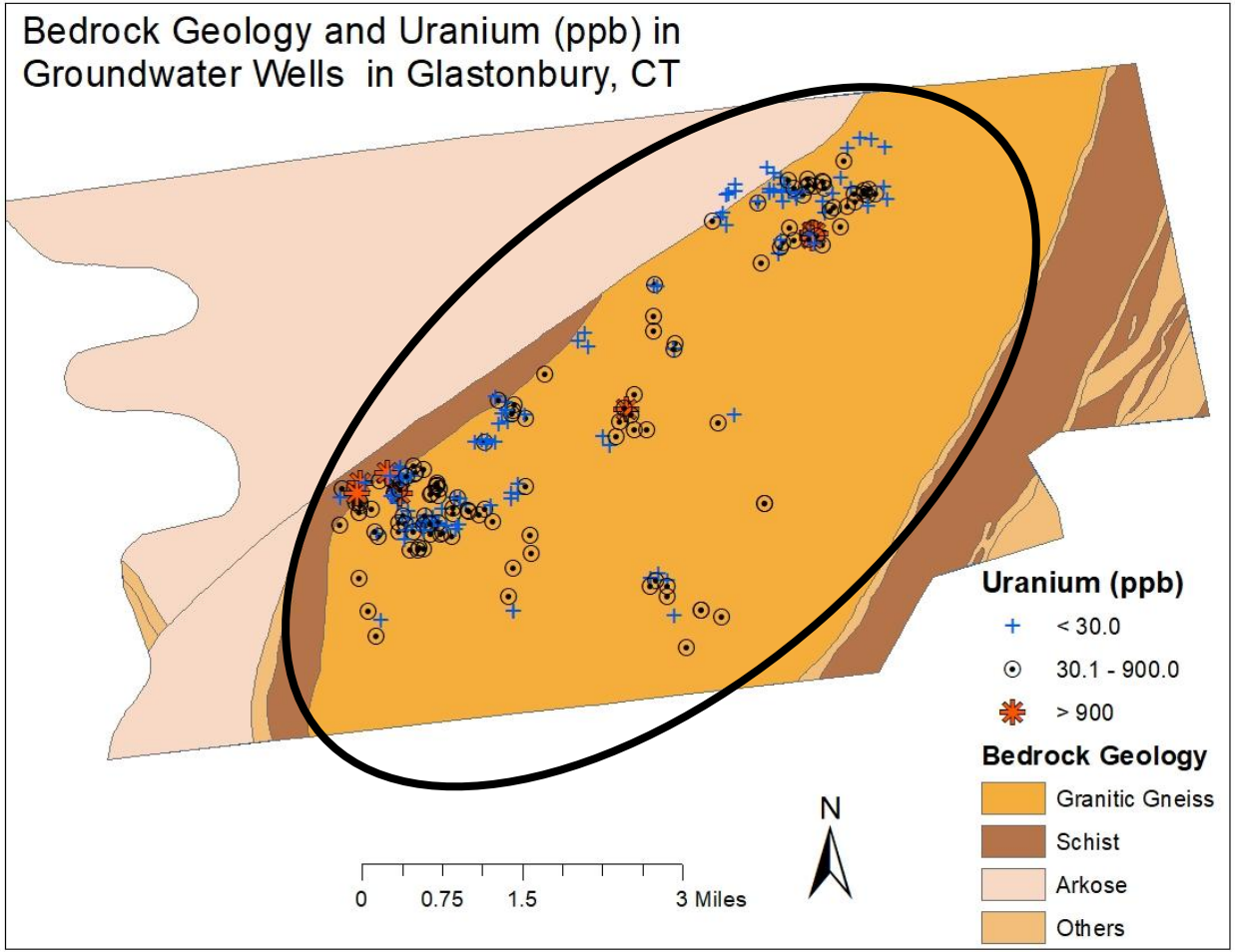
Dr. Hari Kandel
Lake Superior State U.

Minerals in Glastonbury Gneiss

Colorized electron images of of magmatic and metamorphic Titanite in samples from Glastonbury Gneiss (Wintsch et al., 2005)



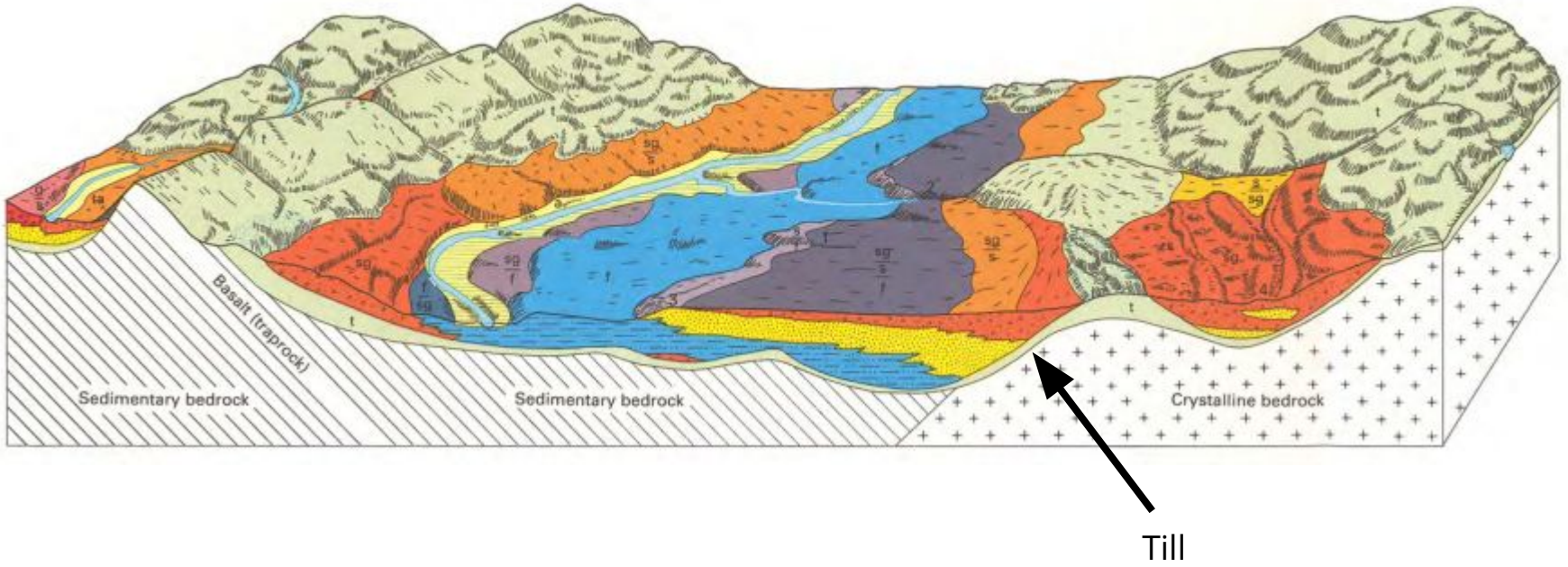
Geology and Uranium



Online GIS data for bedrock geology can be found at:

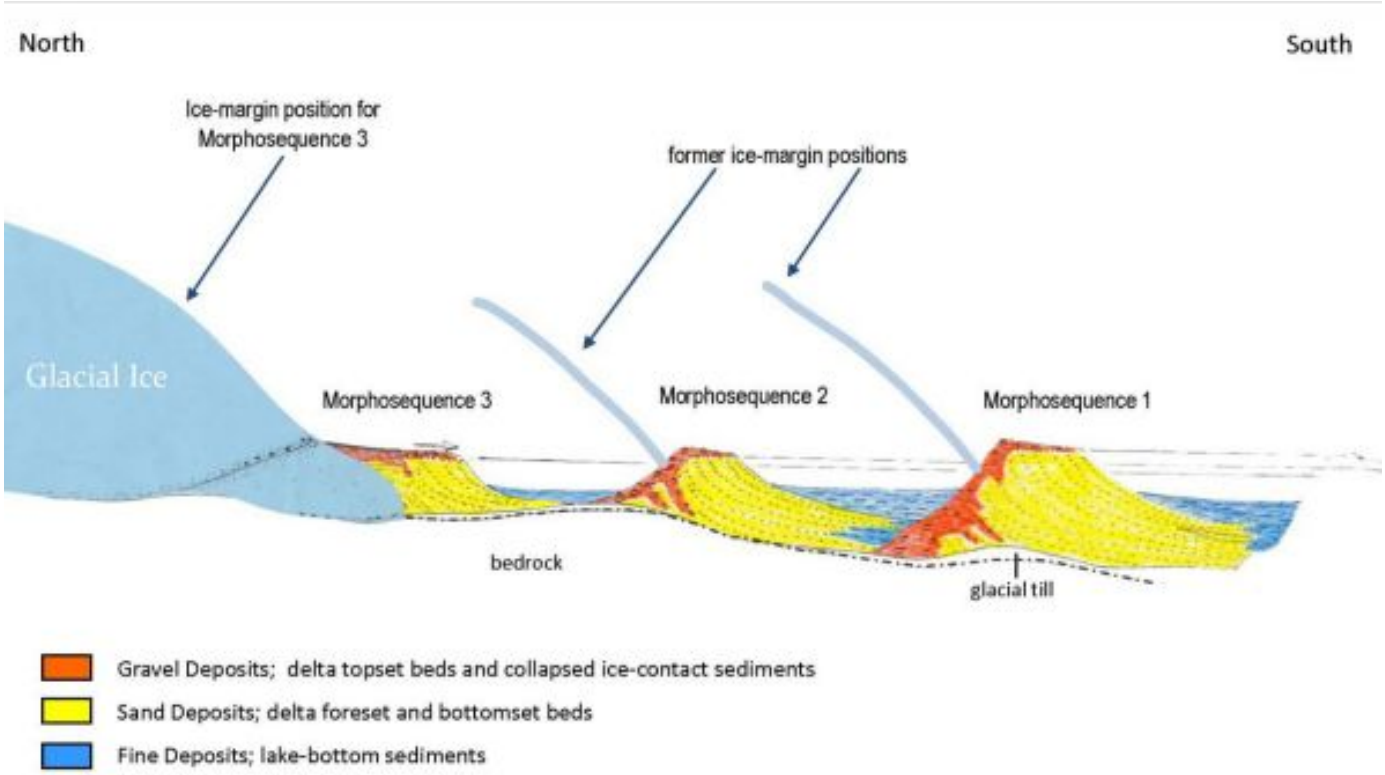
https://ct-deep-gis-open-data-website-ctdeep.hub.arcgis.com/datasets/CTDEEP::bedrock-geology/explore?location=41.686613%2C-72.560550%2C12.00

Quaternary Geology



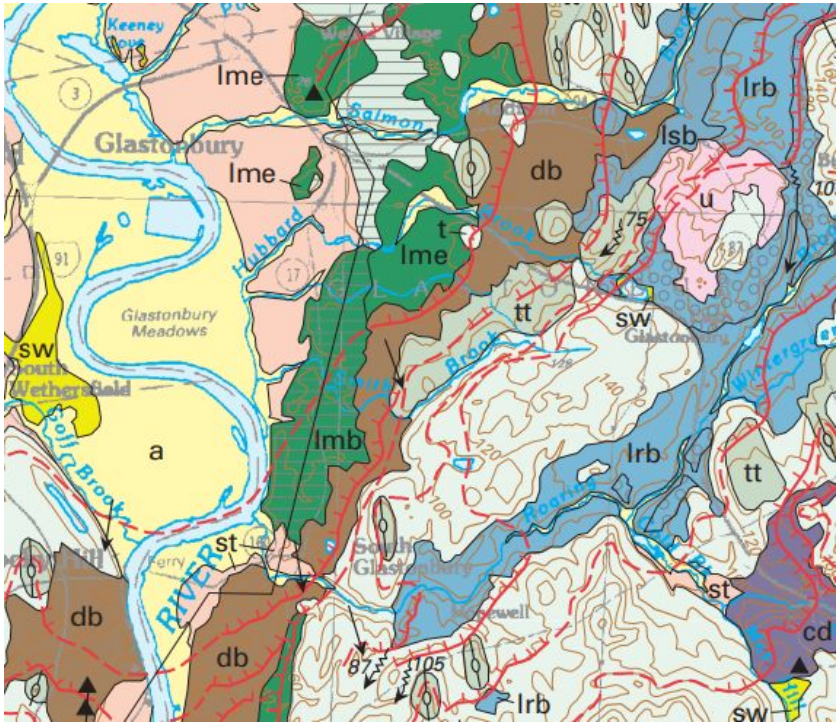
(USGS Open-File Report 85-266)

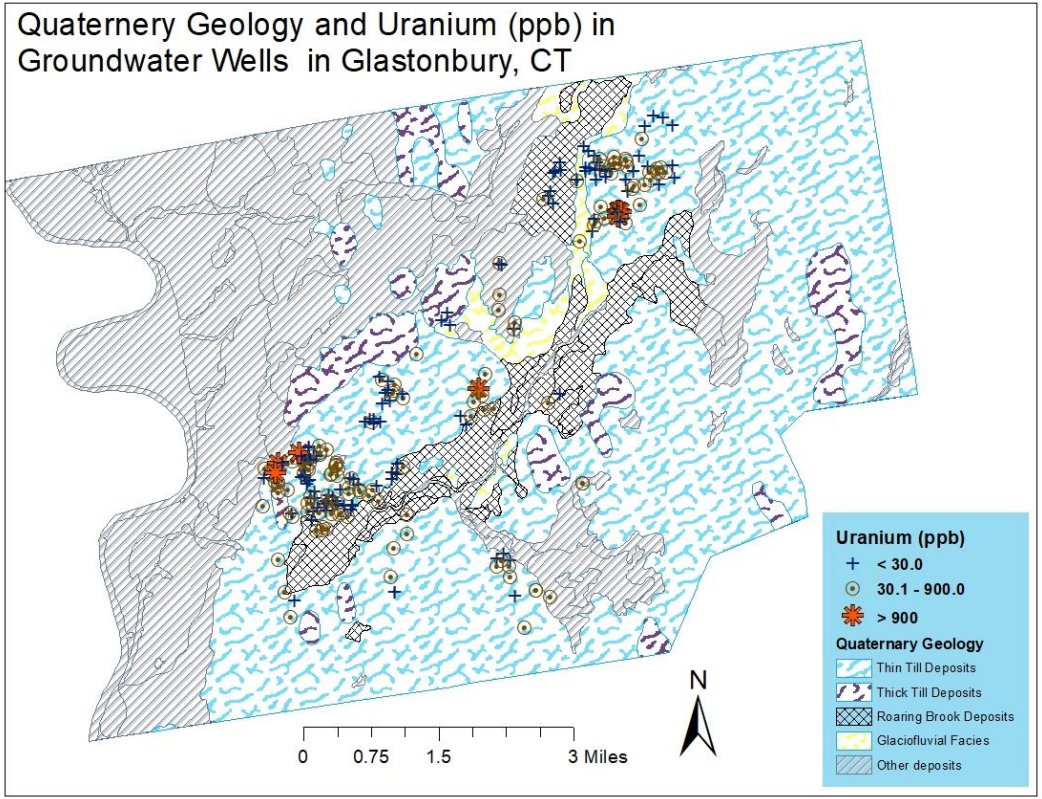
Quaternary Glacial Deposits



Online GIS Data for Quaternary Geology:
https://ct-deep-gis-open-data-website-ctdeep.hub.arcgis.com/datasets/CTDEEP::quaternary-geology-features-set/explore?layer=2&location=41.691292%2C-72.567964%2C12.00

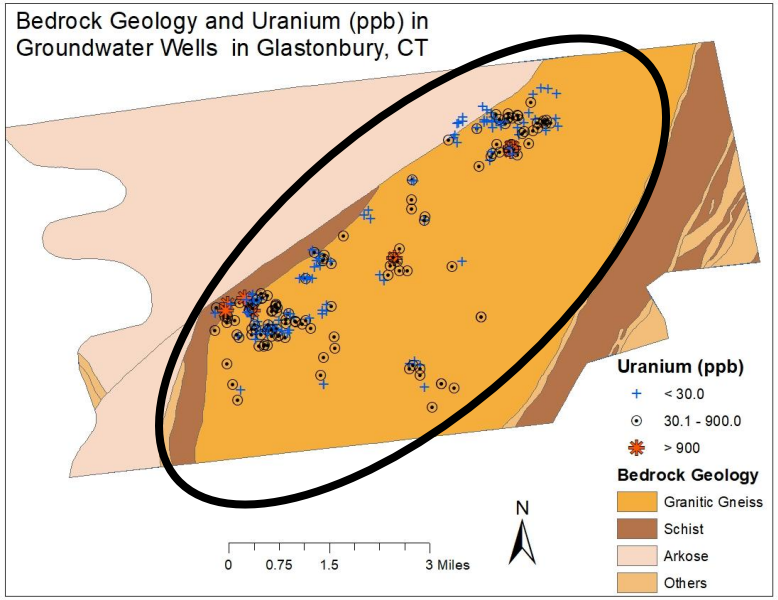
Quaternary Geology and Uranium in Glastonbury: Zoomed In

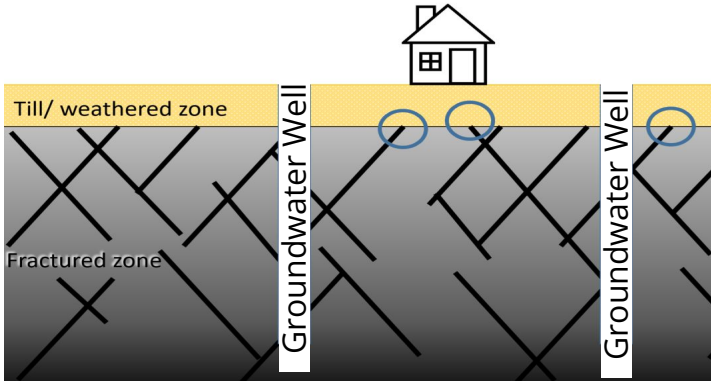




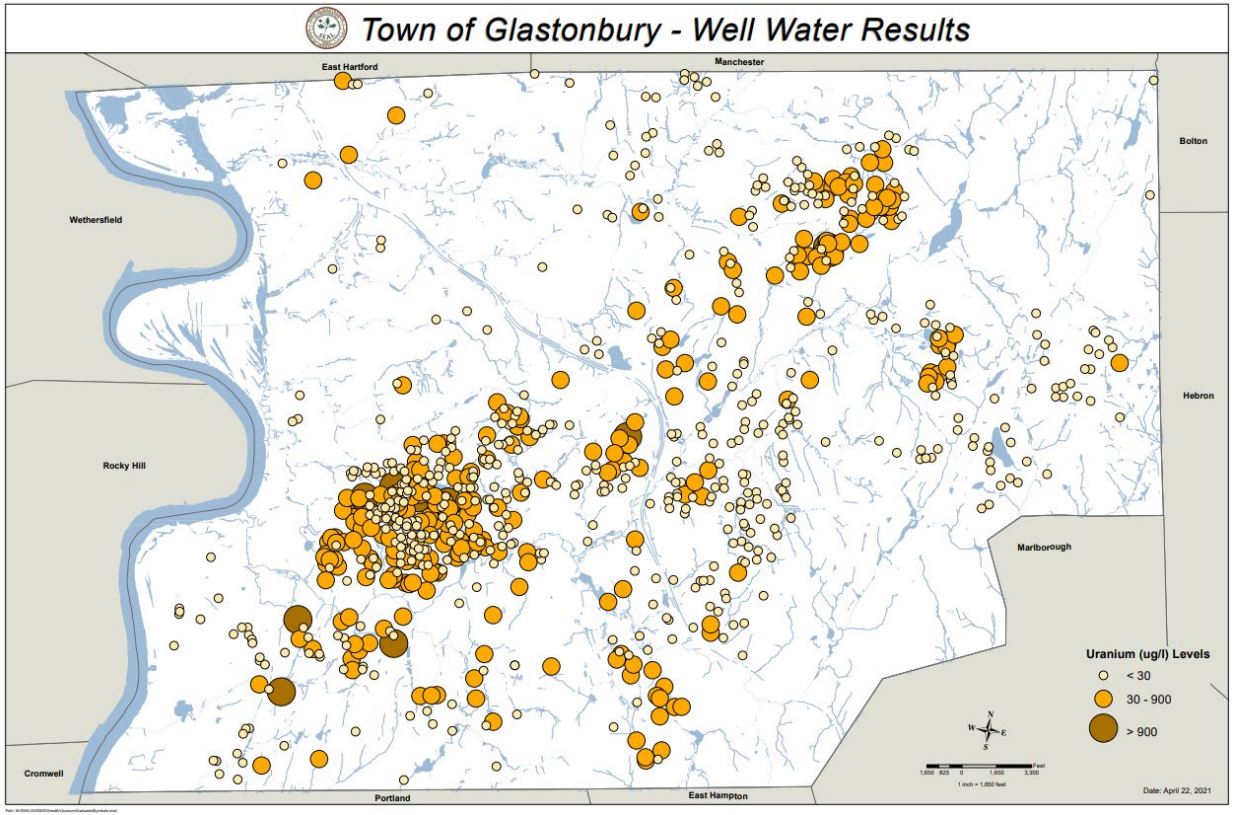
“So what?”: Geology

- Presence of uranium is primarily associated with the Glastonbury Gneiss
  - Rock layers (east of fault) dipping towards west may have favored oxygenated water flowing towards west/southwest
- High uranium concentration corresponds to areas with or adjacent to thin till
  - Thin till areas have enhanced surface water (oxygenated) recharge



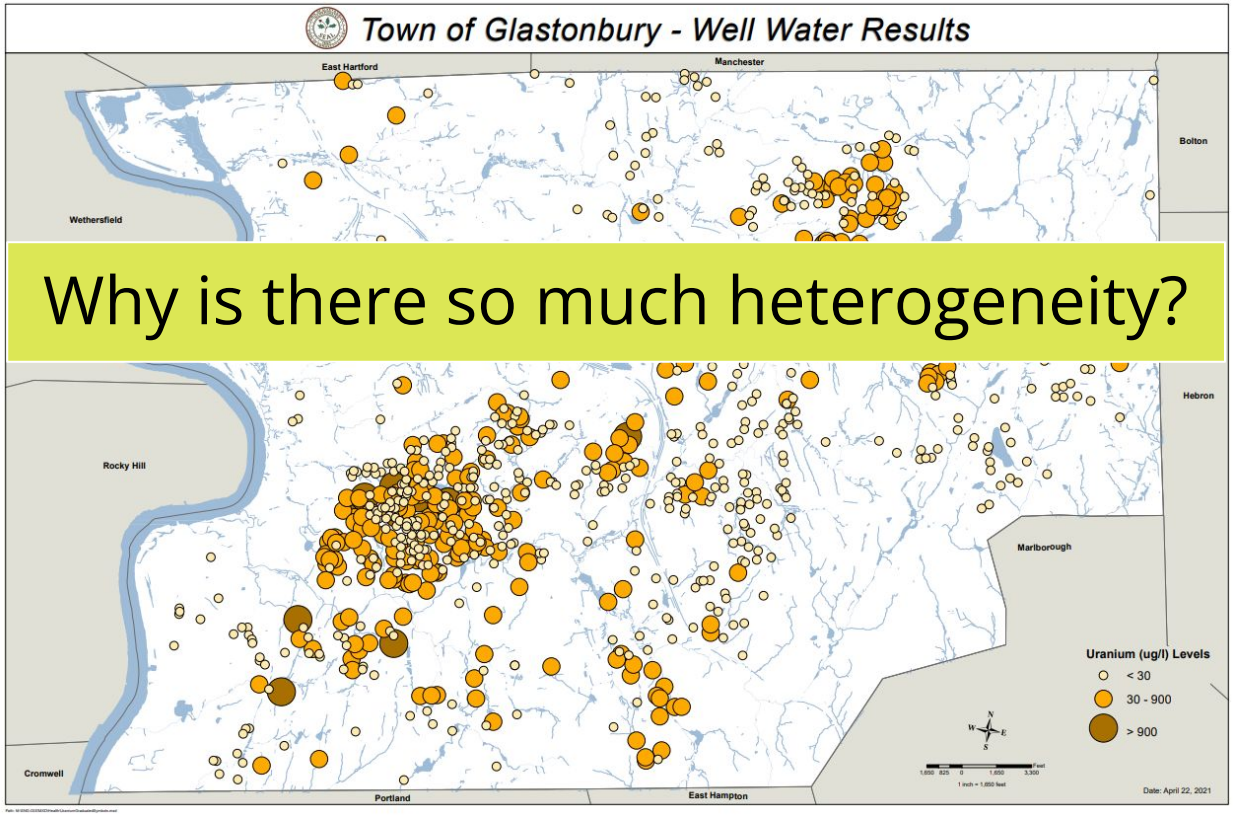


Geology and Water Chemistry



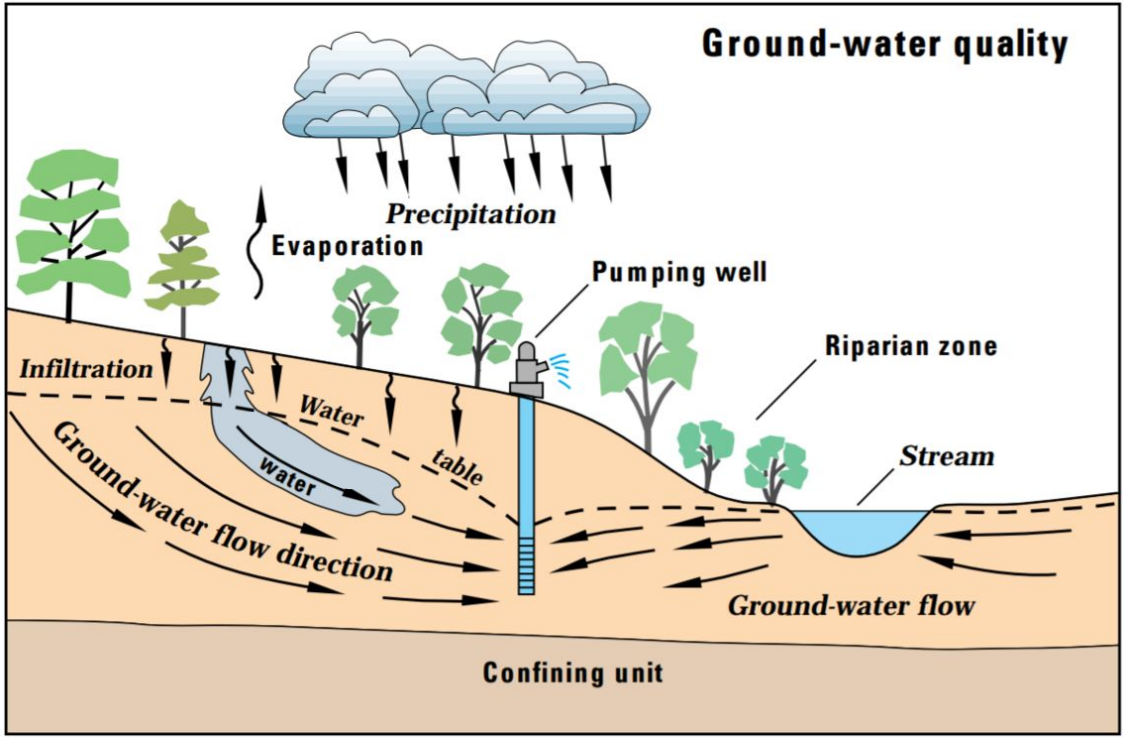
Dr. Rachel Coyte
Ohio State U.

Geology and Water Chemistry



Why is there so much heterogeneity?

Water from Water Wells

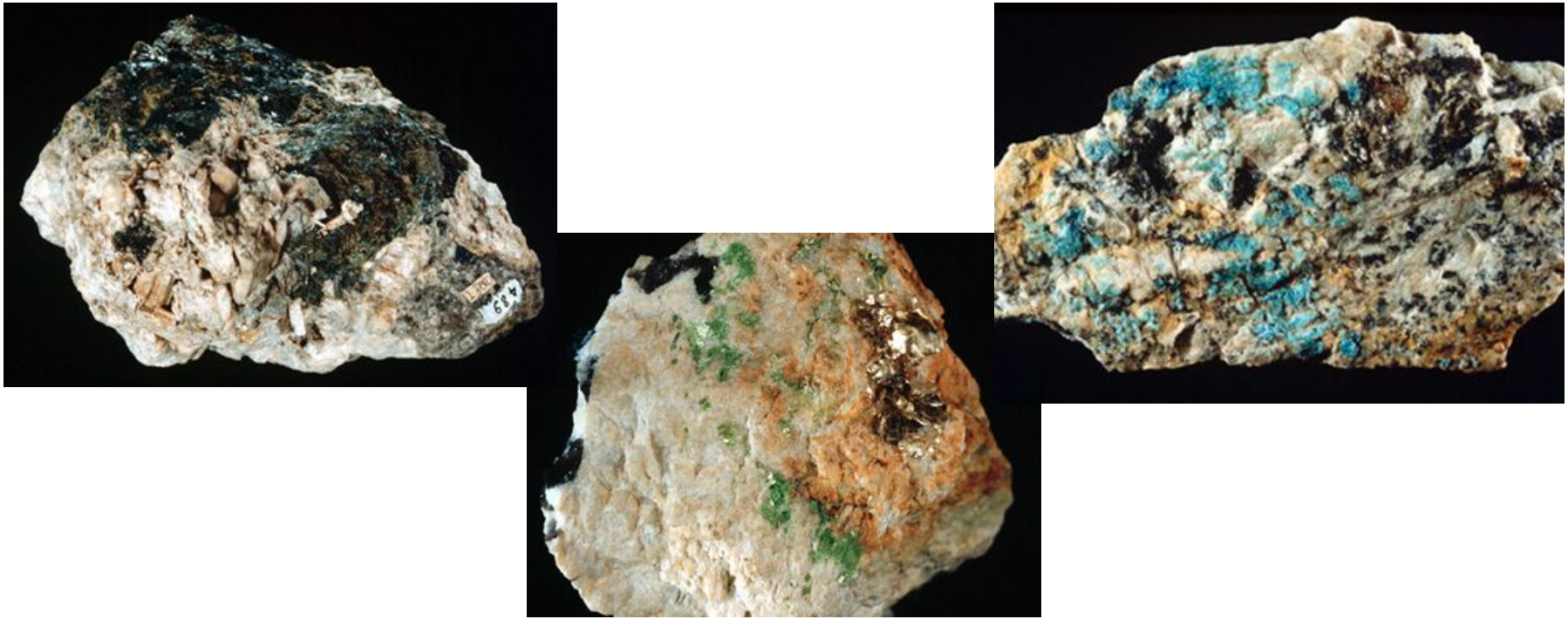


(Modified from USGS)

Geology is Heterogenous

From National Carpet Outlet Mall

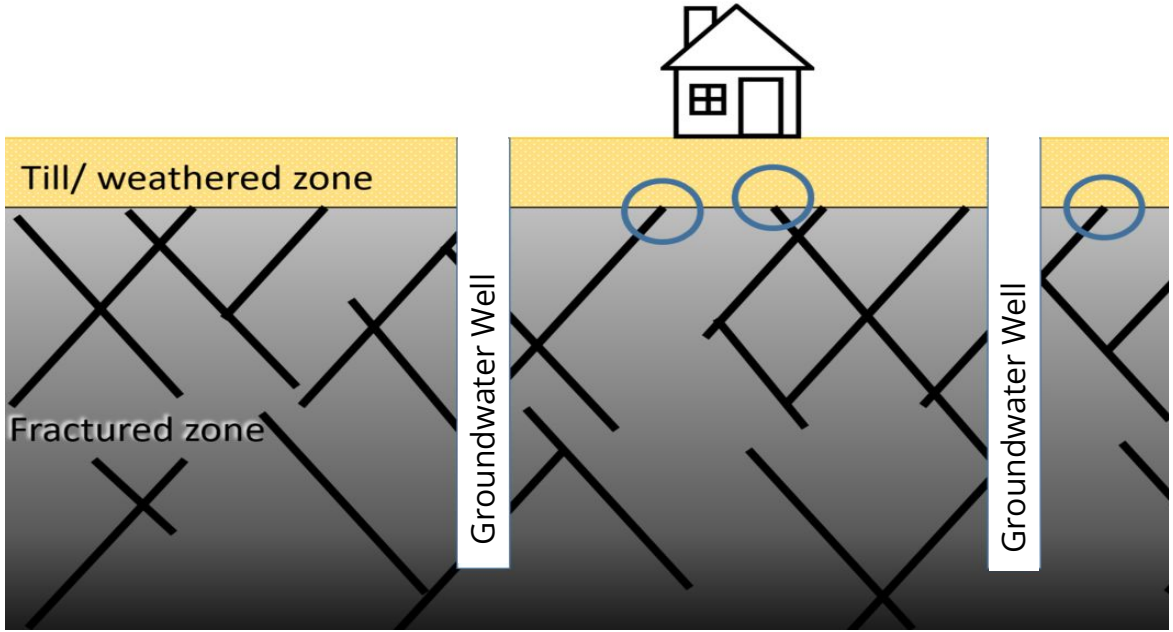
Geology is Heterogenous



From Wesleyan University Natural History Museum via John Betts Fine Minerals

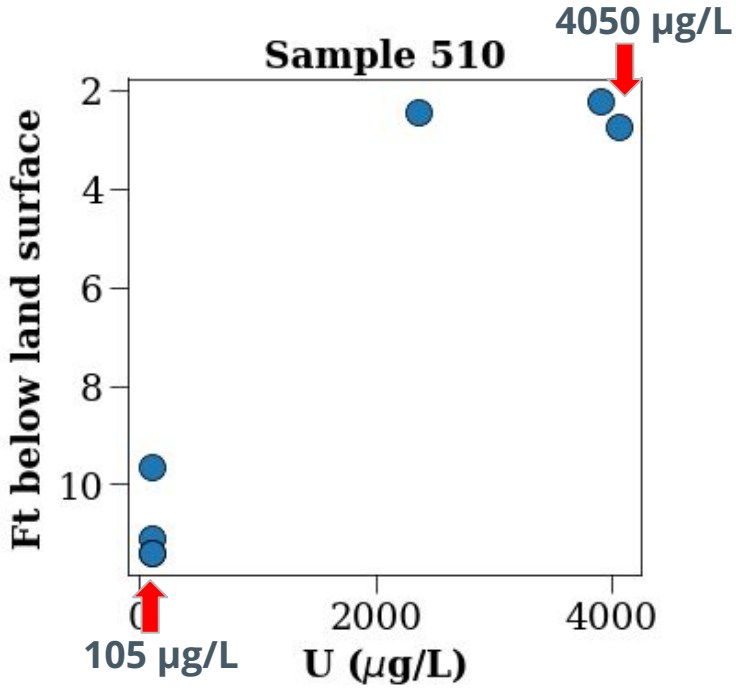
Geology is Heterogenous

- Wells next to each other may not get water from the same place

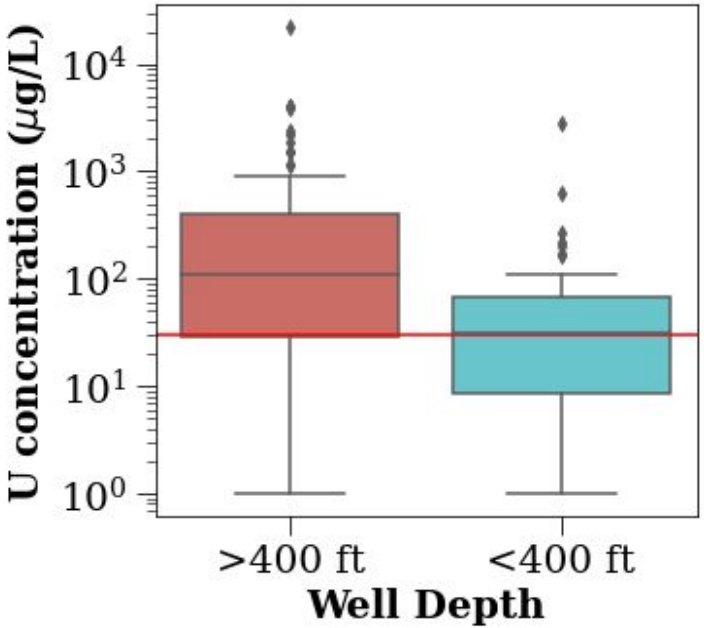


Water level impacts uranium concentration

- Seasonality
- Local geological variability

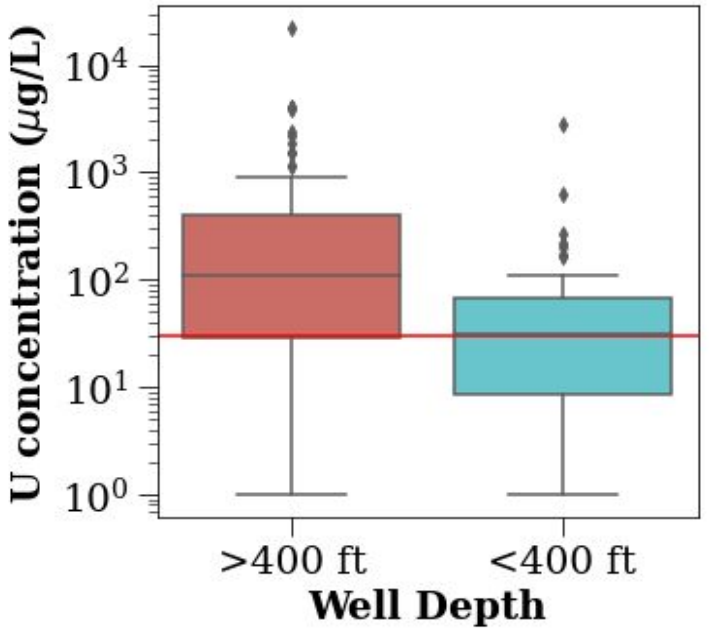


Deeper wells often have higher uranium concentrations



“So what?”: Geology and Water Chemistry

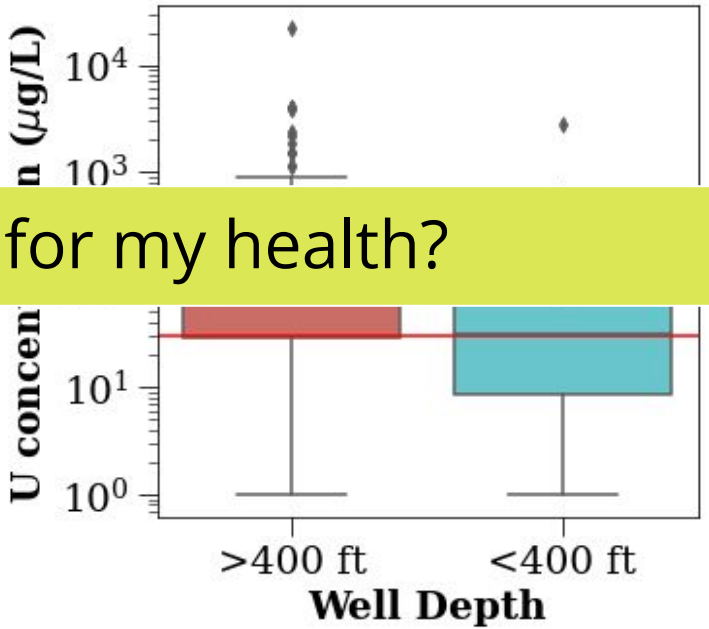
- Spatial heterogeneity is high
- U concentrations may change seasonally
- Wells that are deeper usually have higher uranium levels



“So what?”: Geology and Water Chemistry

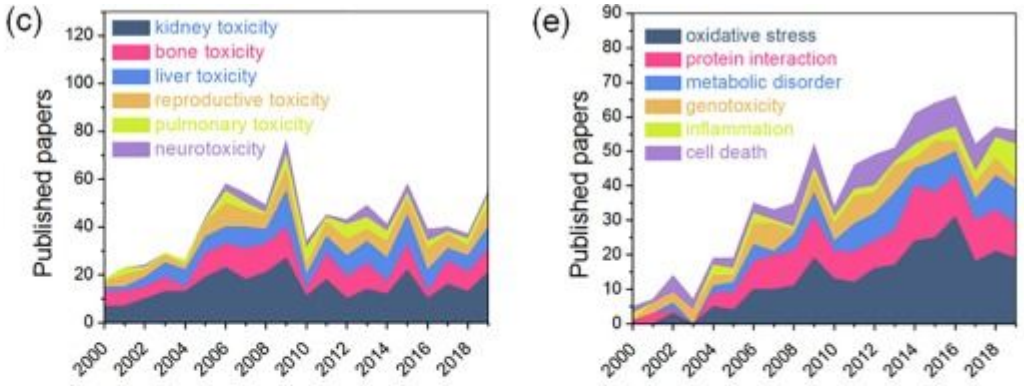
- Spatial heterogeneity is high
- U concentrations may change seasonally

What does this mean for my health?



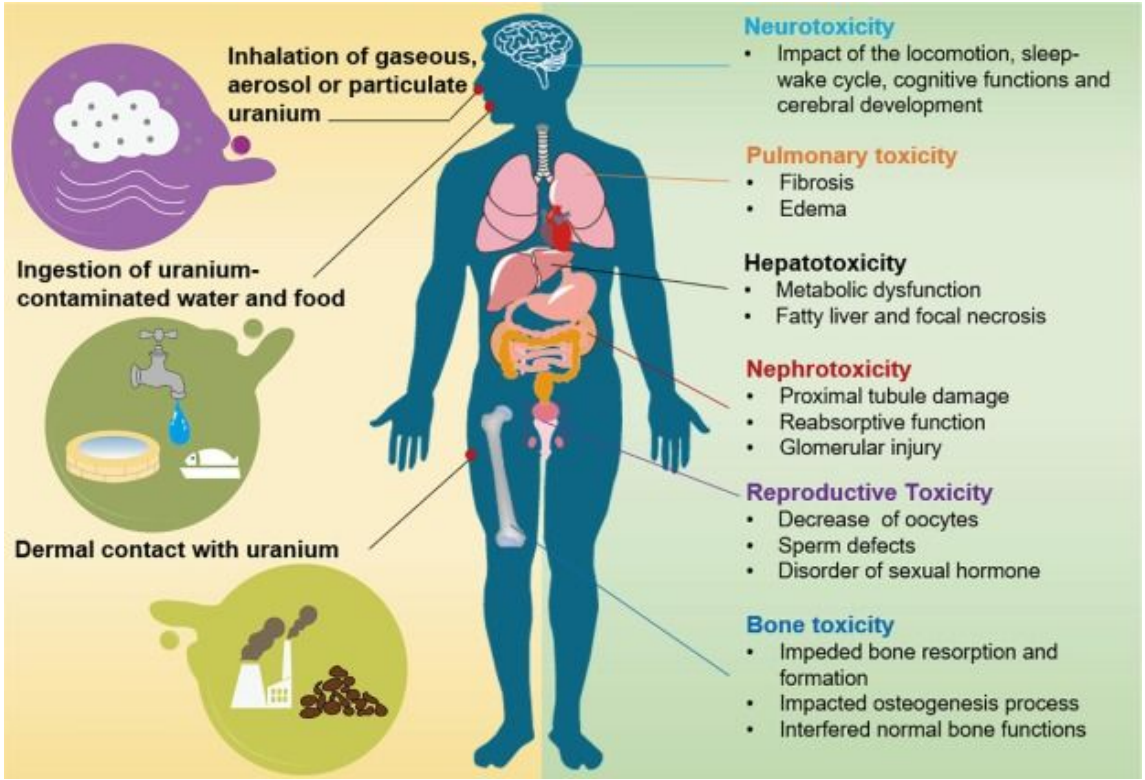
“Why is uranium a potential hazard? Not a for sure hazard?”

- Risks of uranium on health depend on:
  - Concentration
  - Mode and duration of exposure
- Biological mechanisms unclear
  - Controlled human studies are unethical
- More studies are coming out working to answer this!



(Ma et al., 2020)

“What effects can this dissolved uranium have on my health?”



(Ma et al., 2020)

“Should I test my well water?”

- If you’re using private well water, YES
  - Your neighbor’s measurements may not be yours!
- http://www.glastonburyct.gov/uranium has a list of vetted companies at the end of the page
  - Each has their own sampling protocol! Look first!

Dr. Caitlyn Hall
U. of Arizona

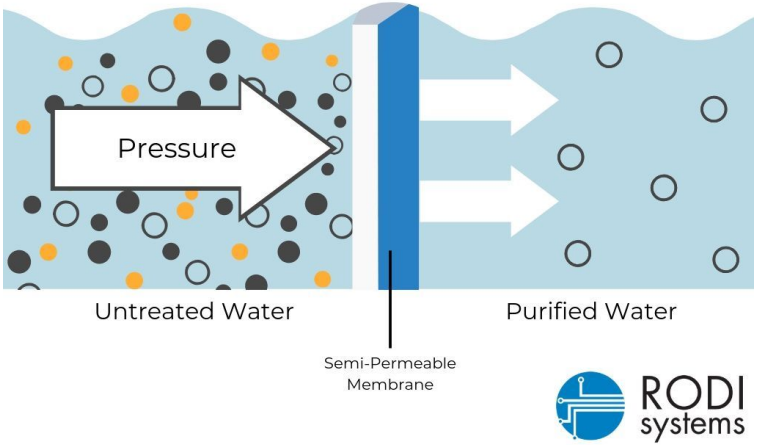
“Uranium was found in my well water. Now what?”

Go to http://www.glastonburyct.gov/uranium
for the most up-to-date guidance and information

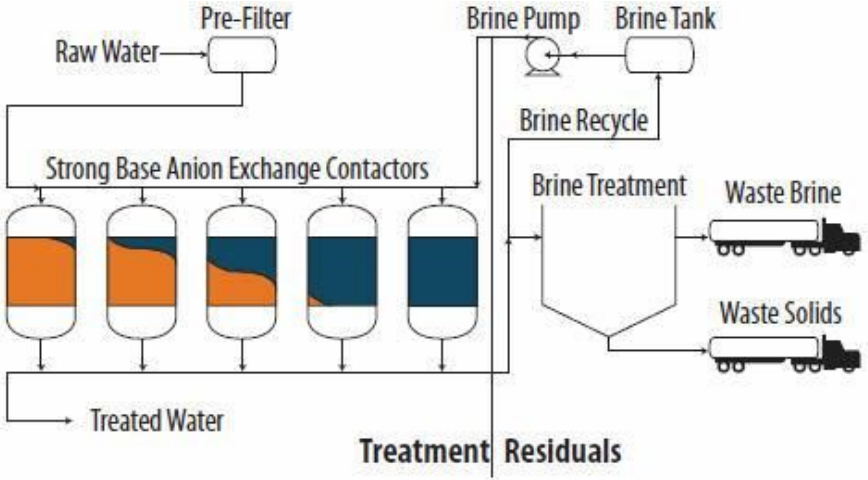
- Report your results
- Call your water treatment company or call the Glastonbury Health Department at (860) 652-7534 to talk water treatment options

Water Treatment Options

Point of Use: Reverse Osmosis
Initial Cost: $
Upkeep: $$



Whole House: Anion Exchange
Initial Cost: $$$
Upkeep: $



(Smith et al., 2016 with Water Online)

Glastonbury is Exploring Options

- Working to extend public water service with Tighe & Bond (engineering consultancy)
- Working towards infrastructure funding assistance opportunities to alleviate homeowner costs to get on public water
- Legislation is pending for state-wide measurement of uranium in groundwater

(Yardis, 2018)

Going Forward

- The most up-to-date info is on the Town of Glastonbury's website: http://www.glastonburyct.gov/uranium
- You can find guidance on:
  - Who to contact for questions
  - Water sampling protocol
  - What to do if you have uranium in your well water

(Yardis, 2018)

Thanks for joining! - The Team

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Questions from the community!

What rocks and minerals in Glastonbury contain uranium?

- Many uranium-bearing minerals have been found in Glastonbury like:
  - Uraninite (pitchblende) in veins and in pegmatite
  - Titanite in K-Feldspar megacryst
- Accessory minerals
  - Monazite (contains UO2 as solid solution)
  - Zircon
  - Apatite
  - Allanite
- U sorbed along crystal boundaries of biotites
- Secondary minerals: Uranyl silicates
- We don’t know which is the exact source of uranium in groundwater

Dr. Hari Kandel
Lake Superior State U.

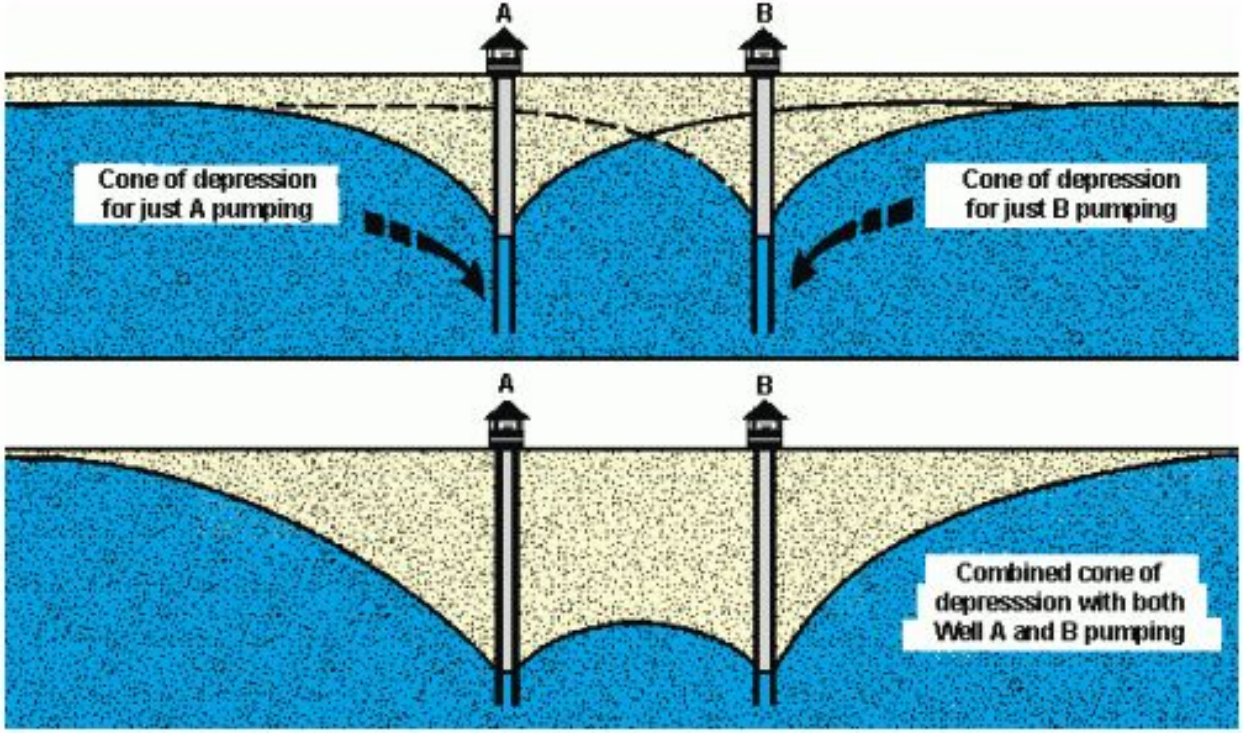
Why is water level different between wells?

- Water table tend to mimic topography unless
  - over-pumping lowers it.
  - Change in precipitation changes it
- Water level and flow to wells depends on:
  - hydraulic conductivity (size, density, and connectivity of fractures); wells with higher hydraulic conductivity and gradient can rise higher and produce greater yield.
  - Distance and direction to recharge/discharge areas
- Best option to ensure water access is dependent on each location and should be explored with the appropriate permitting department

Dr. Hari Kandel
Lake Superior State U.

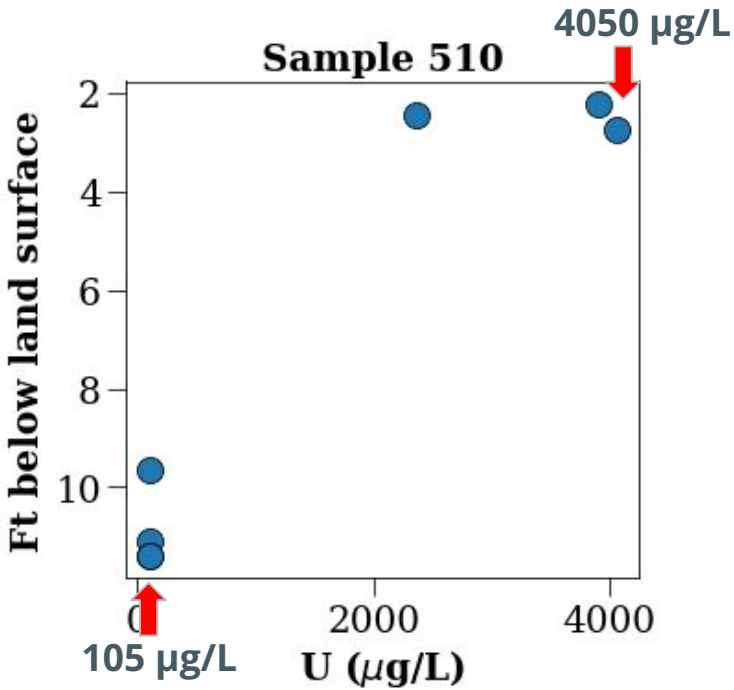
Water level question cont'd...

Well Interference



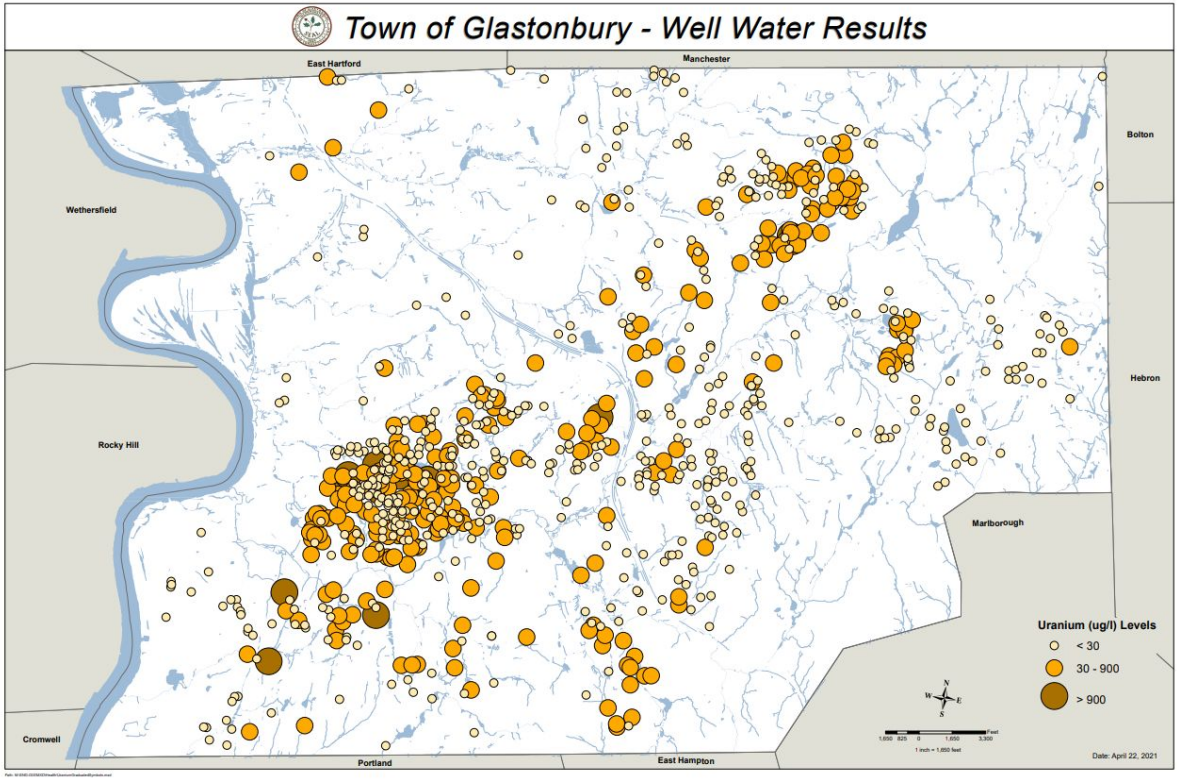
Should I test my well at different times of the year?

- Yes! Spring and fall just to be safe
- We see that groundwater levels impact uranium concentration
  - Geology likely impacts if uranium concentration is higher or lower with groundwater levels



Dr. Rachel Coyte
Ohio State U.

How do I find information about a specific home or area?



- House-specific data is not public
  - Privacy reasons
- We've compiled maps here that can show general area

http://www.glastonburyct.gov/uranium

Dr. Caitlyn A. Hall

What is the town's plan for building sites within the areas impacted?

- The town does not build private sites
- Land development requires regulatory review and must have access to potable water
- Since May 2019, all new wells must be tested for uranium and radon before they are approved for use

Dr. Caitlyn A. Hall

Well water or expand public water access?

Private Well Water

- Less expensive
- Residences are already set up for well water
- More likely to be impacted by groundwater contamination and water levels

Public Water Utility

- Lower risk of water scarcity and contamination
- More expensive
- Requires infrastructure

Dr. Caitlyn A. Hall

What water treatments exist now?

- We haven’t seen a uranium concentration level that couldn’t be addressed with at-home treatments
  - Reverse osmosis
  - Anion exchange

Dr. Caitlyn A. Hall

Are there existing medical checks for long-term exposure to high uranium levels?

- To our knowledge, there’s not a specific panel to determine if your personal health has been impacted by uranium
- Our suggestion: talk to your doctor or call the Connecticut State Department of Health

Dr. Caitlyn A. Hall

When will access to public utility water happen?

- Initial cost estimates in 2019/2020 to transition impacted areas were costly
- We cannot give you a firm date, but town leadership is actively working on this
- All updates will be announced publicly and will be on: **https://www.glastonburyct.gov/uranium**

Dr. Caitlyn A. Hall

How is the Town trying to alleviate costs?

- The Town is currently exploring options for state- and federal-level funding opportunities to help reduce the cost to citizens for expanding to public water utility access and/or to aid in remediation
- More information on this front is in the works and will be made public as soon as possible

Dr. Caitlyn A. Hall