

# GROUNDWATER PROTECTION AND CARBON STORAGE

Presented by

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UNIVERSITY OF  
**ILLINOIS**  
URBANA-CHAMPAIGN



# ILLINOIS STATE GEOLOGICAL SURVEY

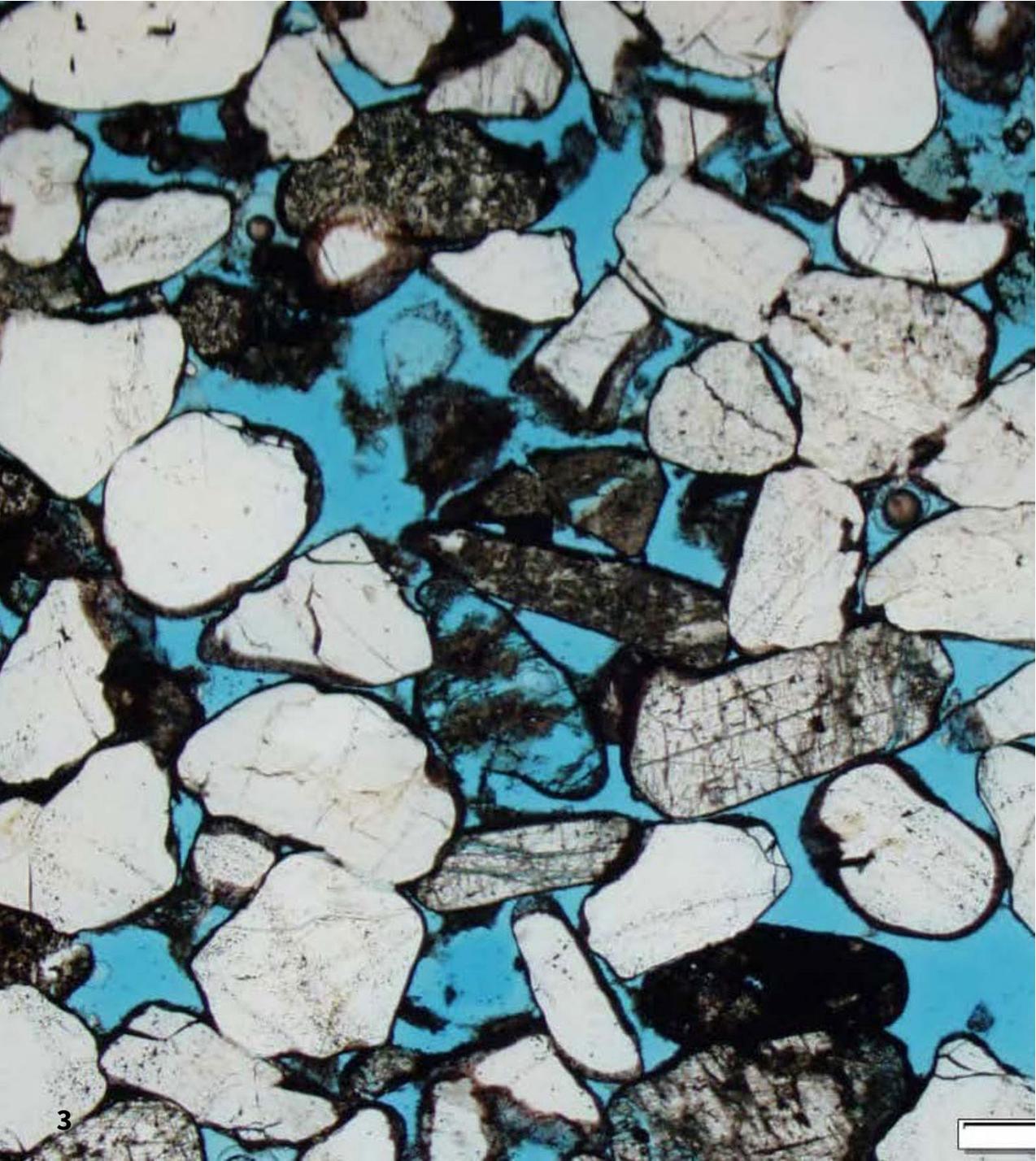
[isgs.illinois.edu](https://isgs.illinois.edu)

## A resource for all stakeholders

- Repository for geologic and natural resource data
- Accurate, objective earth science research and information

## We support Illinois

- Protection of environmental quality
- Economic development
- Public safety

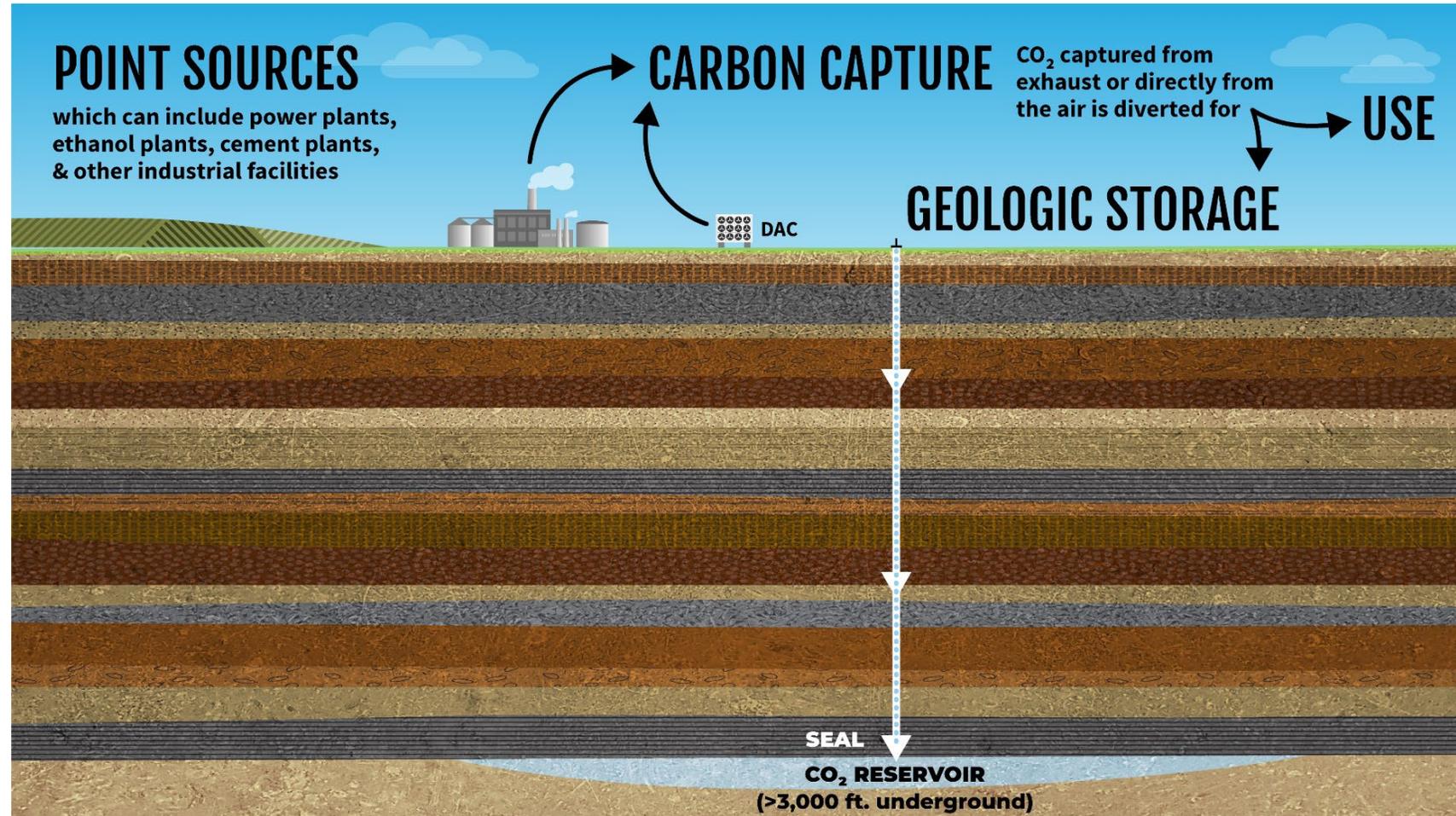


**THE EARTH STORES  
WATER, SALINE WATER,  
OIL, AND NATURAL GAS  
IN PORE SPACES OF  
ROCK UNITS**

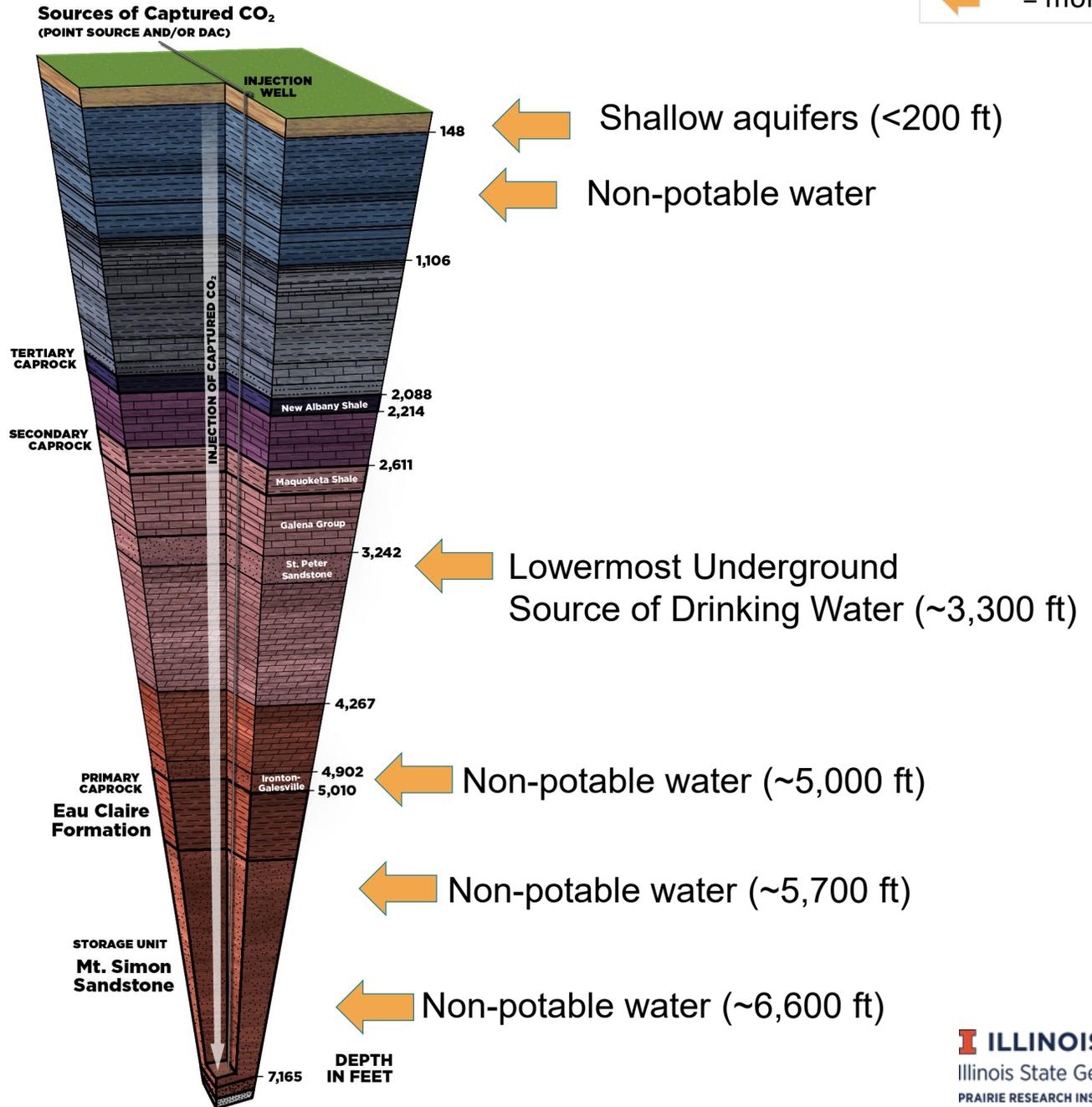
# CARBON CAPTURE UTILIZATION AND STORAGE (CCUS)

- Recognized as an effective means of achieving mid-century emissions reduction goals
- Transitional technologies to allow the world to reduce carbon emissions on the path to net zero

REPORT: CCUS in Illinois, PRI, 2022



# ILLINOIS BASIN GEOLOGY (NEAR DECATUR, IL)



# MAHOMET AQUIFER PROTECTION

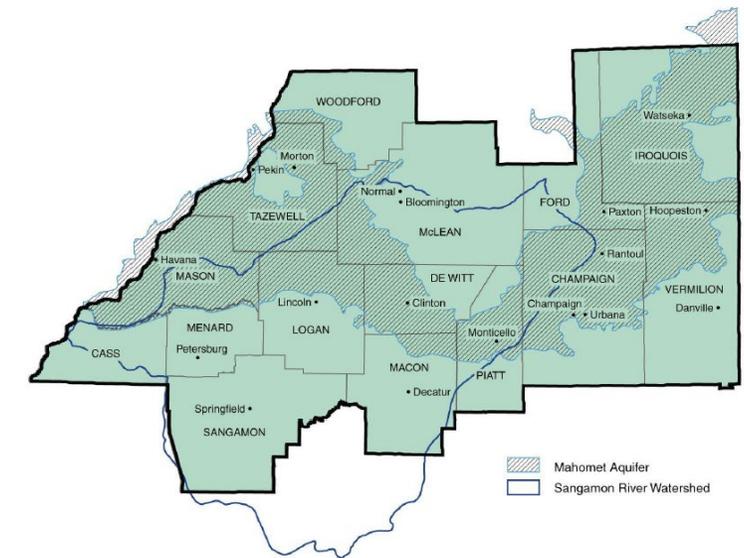
In 2018, the **Mahomet Aquifer Protection Task Force identified current and potential contamination threats** to the water quality of the Mahomet Aquifer, including:

- **Potential routes** (abandoned wells)
- **Potential threats** (legacy landfills)
- **Threats** (nitrate, arsenic, road salt, inadequate source water protection, household hazardous waste, pharmaceuticals and personal care products, underground natural gas storage)

## MAHOMET AQUIFER PROTECTION TASK FORCE: FINDINGS AND RECOMMENDATIONS

Published Dec. 21, 2018

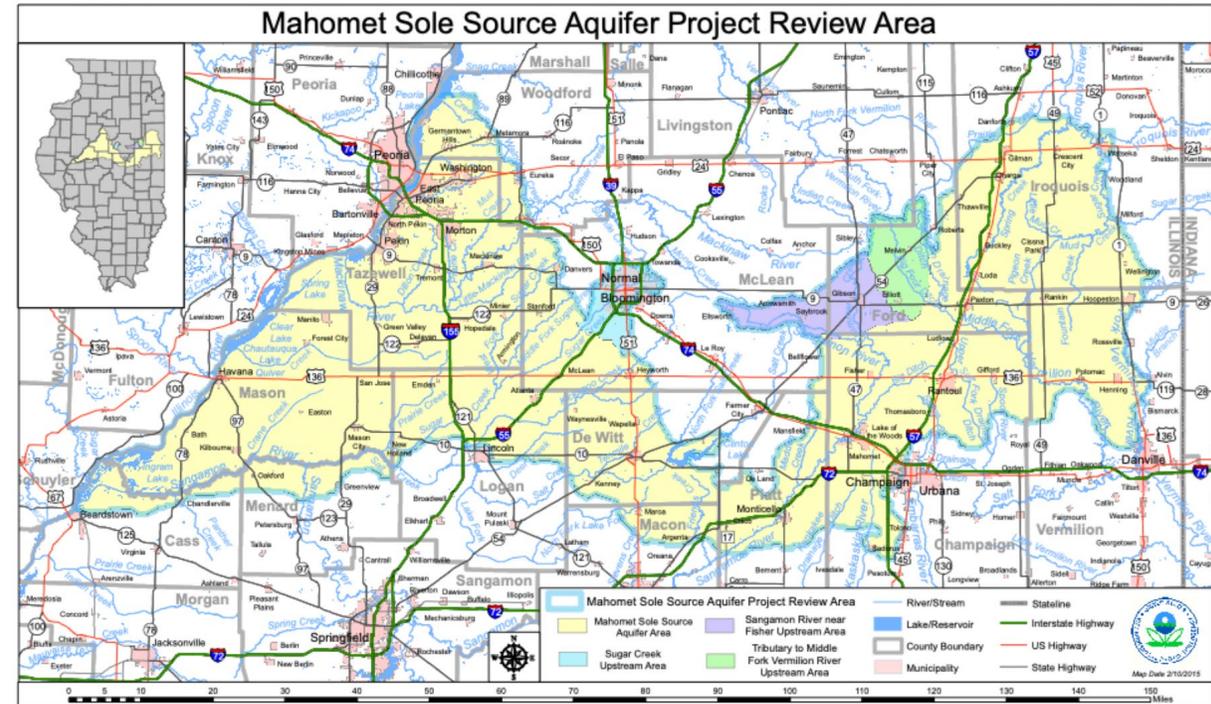
Authored by Task Force members Carol Ammons, Eric Ballenger, Teresa Barnett, Scott Bennett, Alec Davis, Deborah Frank-Feinen (chair), Keith Gleason, Donovan Griffith, Charles Hostetler, Lynn Karner, Chris Koos, Claudia Lennhoff, Diane Marlin, Alec Messina, Bill Mitchell, Julie Moore-Wolfe, Andrew Rehn, Jim Risley, George Roadcap, Chapin Rose, Charles Smith, Larry Stoner, Steve Turner, Todd Zalucha, and David Zimmerman with additional support from Rick Cobb, Illinois EPA; Randy Locke, Illinois State Geological Survey; and Walt Kelly, Illinois State Water Survey



# EXISTING WELLS WITHIN THE MAHOMET AQUIFER SOLE SOURCE AREA

Well type Category	Number	Percent
Water	19,836	81.5%
Engineering	1,963	8.1%
Structure Test	720	3.0%
Environmental	586	2.4%
Oil	451	1.9%
Gas Storage	320	1.3%
Coal Test	318	1.3%
Other	137	0.6%

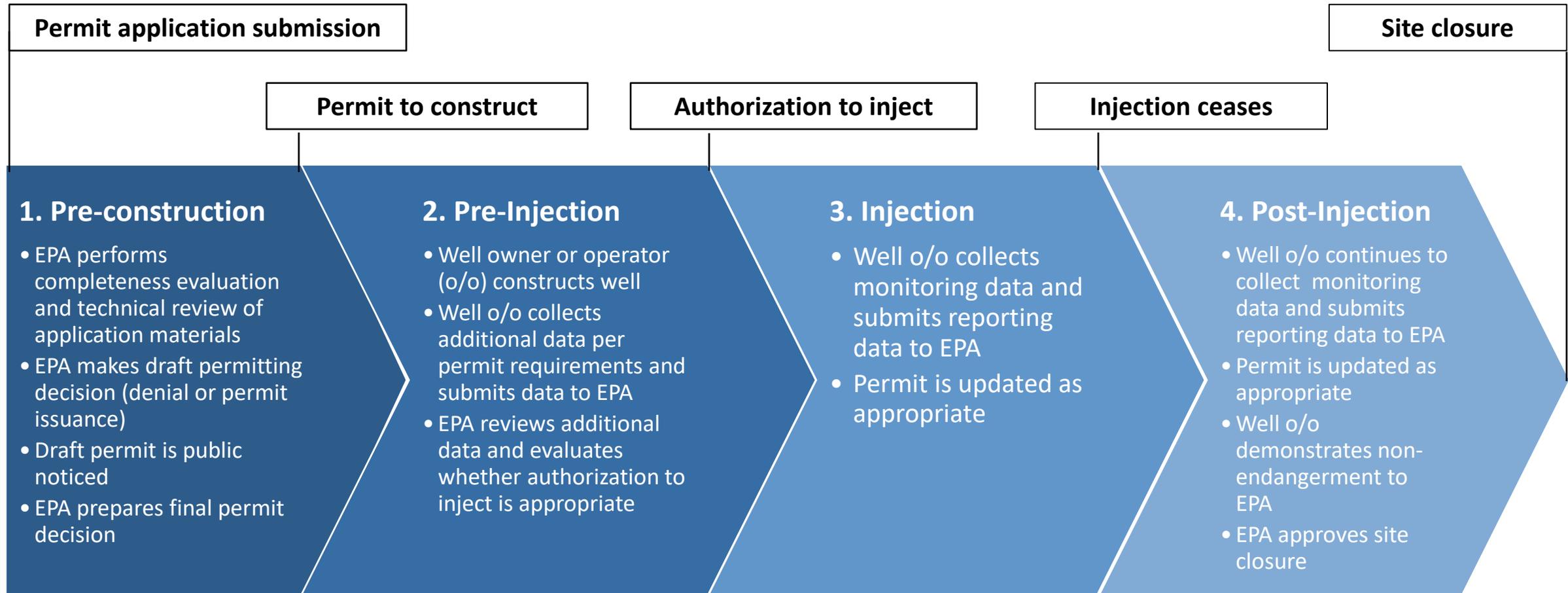
- 24,331 well bores
- 95% less than 400 ft deep
- No carbon dioxide injection wells
- Analysis by N. Webb and D. Garner ISGS well data, December 2024



# UIC CLASS VI WELL PERMITTING

- The primary goal of the federal UIC Class VI regulations is to ensure that underground sources of drinking water are not contaminated by injected carbon dioxide
- Key Requirements:
  - Plans that document siting, infrastructure, operations, monitoring, post closure, emergency response, and financial assurance for a proposed project
    - Site Suitability: Only geologically suitable sites qualify
    - Well Construction Standards: Use of approved design and materials
    - Monitoring Protocols: Regular groundwater monitoring to detect and mitigate issues
- Protects potable groundwater sources, like the Mahomet Aquifer, from potential risks
- Ensures transparency and accountability through periodic reporting to the USEPA

# Class VI Permitting Process



EPA UIC Class VI Website: <https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-carbon-dioxide>

The background of the image is a dark blue, textured surface with a repeating diamond-shaped pattern, characteristic of diamond plate metal. The pattern consists of raised, diamond-shaped ridges that create a three-dimensional effect. The lighting is slightly brighter in the upper right quadrant, giving the surface a subtle gradient.

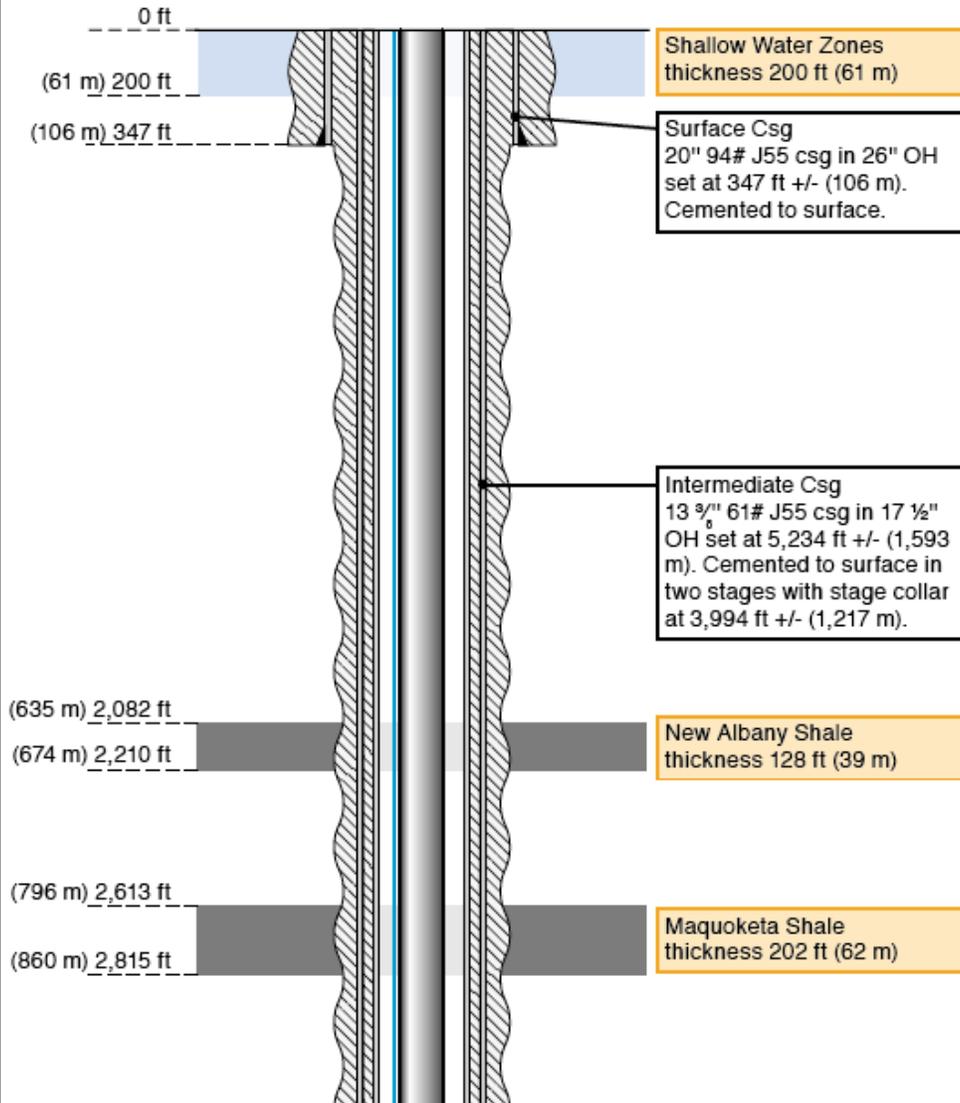
# **WELL DESIGN & RISK MANAGEMENT**

# INJECTION WELL DESIGN

- Use international standards based on decades of well engineering
- Materials meet or exceed standards set by the American Petroleum Institute (API) and American Society for Testing and Materials (ASTM) International
- In zones near drinking water sources, multiple layers of protective steel casing and cement are used to isolate CO<sub>2</sub> from surrounding environments
- Example: Decatur Well CCS2

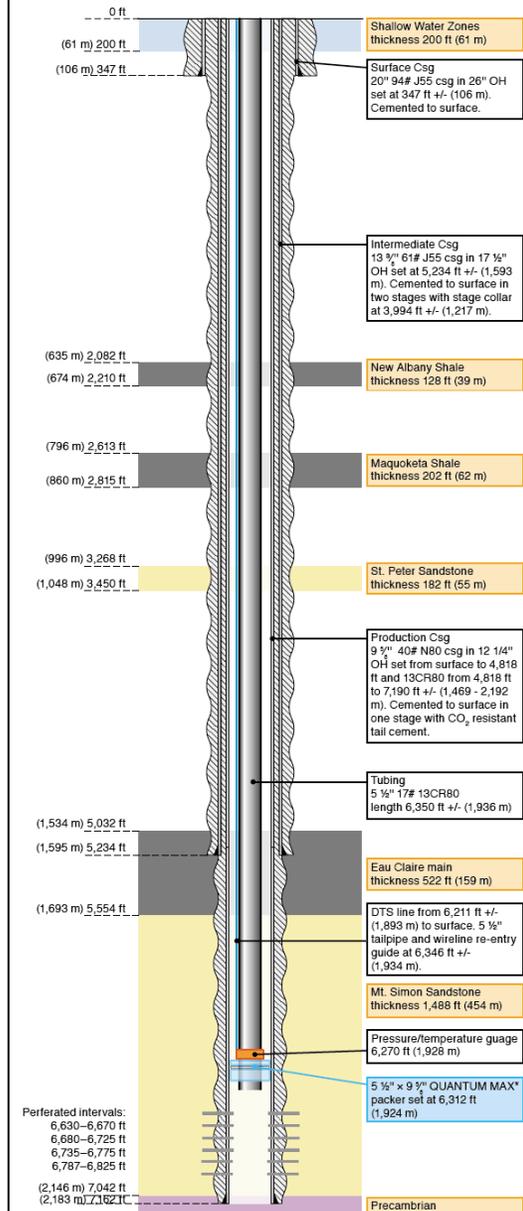
## Injection Well

CCS2



## Injection Well

CCS2



\* Mark of Schlumberger

# RISK MANAGEMENT AND KNOWLEDGE SHARING

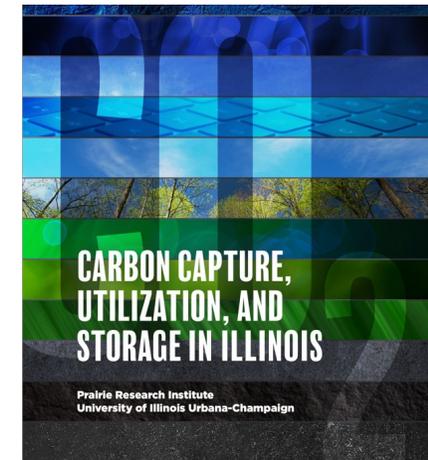
- A thorough risk assessment process was part of the Illinois Basin – Decatur Project ([Hnottavange-Telleen, 2014](#))
  - **123 Features, Events, and Processes (FEPs) listed**
  - **88 scenarios incorporated into site design and operation**
- Monitoring well design at the Decatur storage site was unique and it is **not used in** other Class VI applications
- Knowledge from Illinois has been provided at local to international levels to support informed decision making, regulation, policy, and standards

Illinois CCUS study group

[Public Act 102-0341](#)

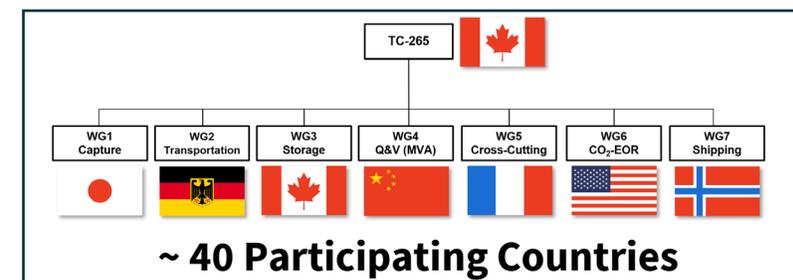
PRI CCUS Report

<https://hdl.handle.net/2142/116416>



International standards on carbon dioxide capture, transportation, and geological storage

ISO/TC 265 Structure



# KEY POINTS

- State (Illinois SAFE CCS Act) and federal (UIC Class VI) permitting prioritize groundwater protection and safe storage
- The risk to the Mahomet Aquifer from carbon storage operations remains low due to siting, data collection, regular reporting, and long-term monitoring requirements
- With 15 years of monitoring to date, PRI has found no evidence of negative impacts from carbon storage to potable groundwater quality

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