How is pore space used?

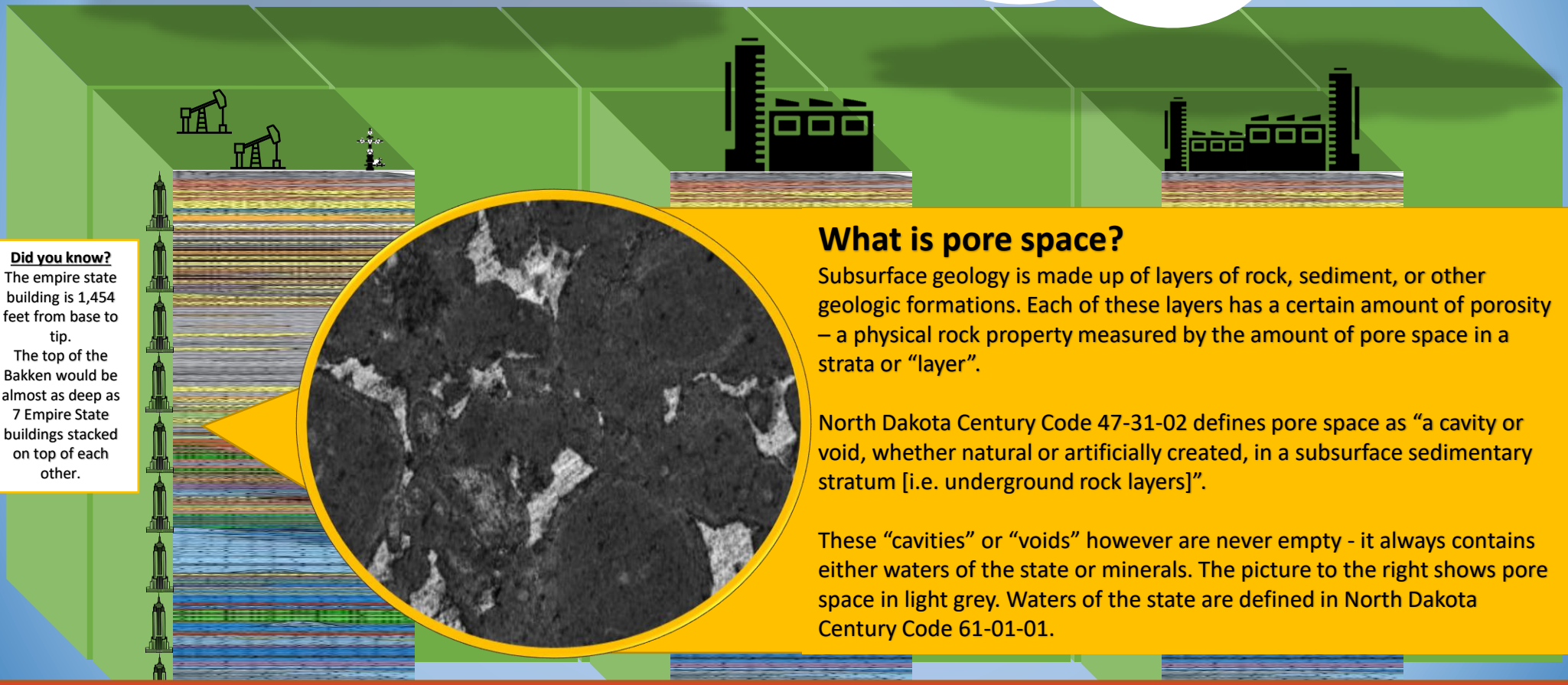
Generally, pore space is used for disposal, storage, and/or enhanced recovery of fluids and/or minerals by means of Underground Injection Control ("UIC") wells.

The North Dakota Oil and Gas Division and the North Dakota Department of Environmental Quality have Underground Injection Control ("UIC") Programs which regulate access to pore space in North Dakota.

Who owns pore space?

In North Dakota, the surface owner also owns the pore space underlying their surface estate.
North Dakota Century Code 47-31-03.

Courts have determined that in a situation where surface and mineral ownership has been severed – the mineral estate is dominant and has the right to use as much of the surface estate as reasonably necessary. The 2019 legislature codified this "common law" in North Dakota Century Code 47-31-08 and 47-31-09



Did you know?
The empire state building is 1,454 feet from base to tip.
The top of the Bakken would be almost as deep as 7 Empire State buildings stacked on top of each other.

What is pore space?

Subsurface geology is made up of layers of rock, sediment, or other geologic formations. Each of these layers has a certain amount of porosity – a physical rock property measured by the amount of pore space in a strata or "layer".

North Dakota Century Code 47-31-02 defines pore space as "a cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum [i.e. underground rock layers]".

These "cavities" or "voids" however are never empty - it always contains either waters of the state or minerals. The picture to the right shows pore space in light grey. Waters of the state are defined in North Dakota Century Code 61-01-01.

PORE SPACE IN NORTH DAKOTA

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How much pore space is used in Class II disposal wells?

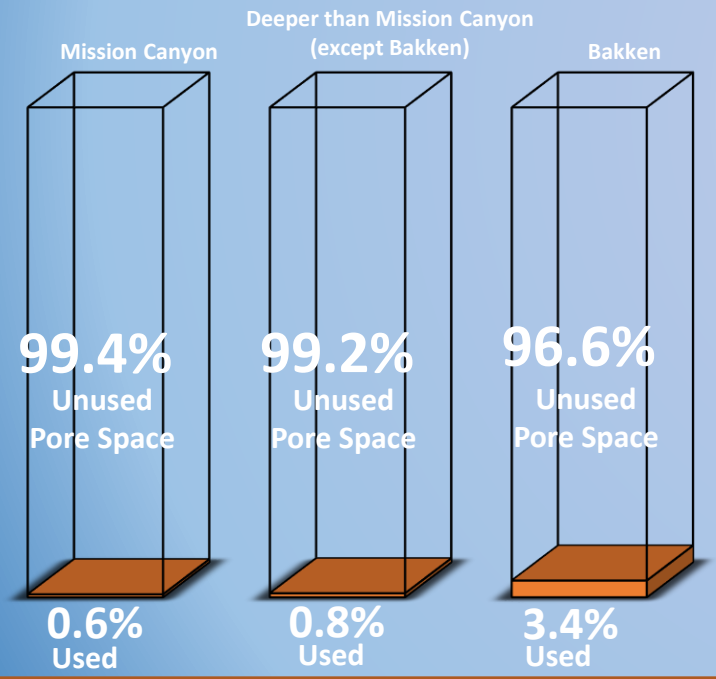
Regulation requires that 1,320 foot (1/4 mile) radius area of review be conducted.

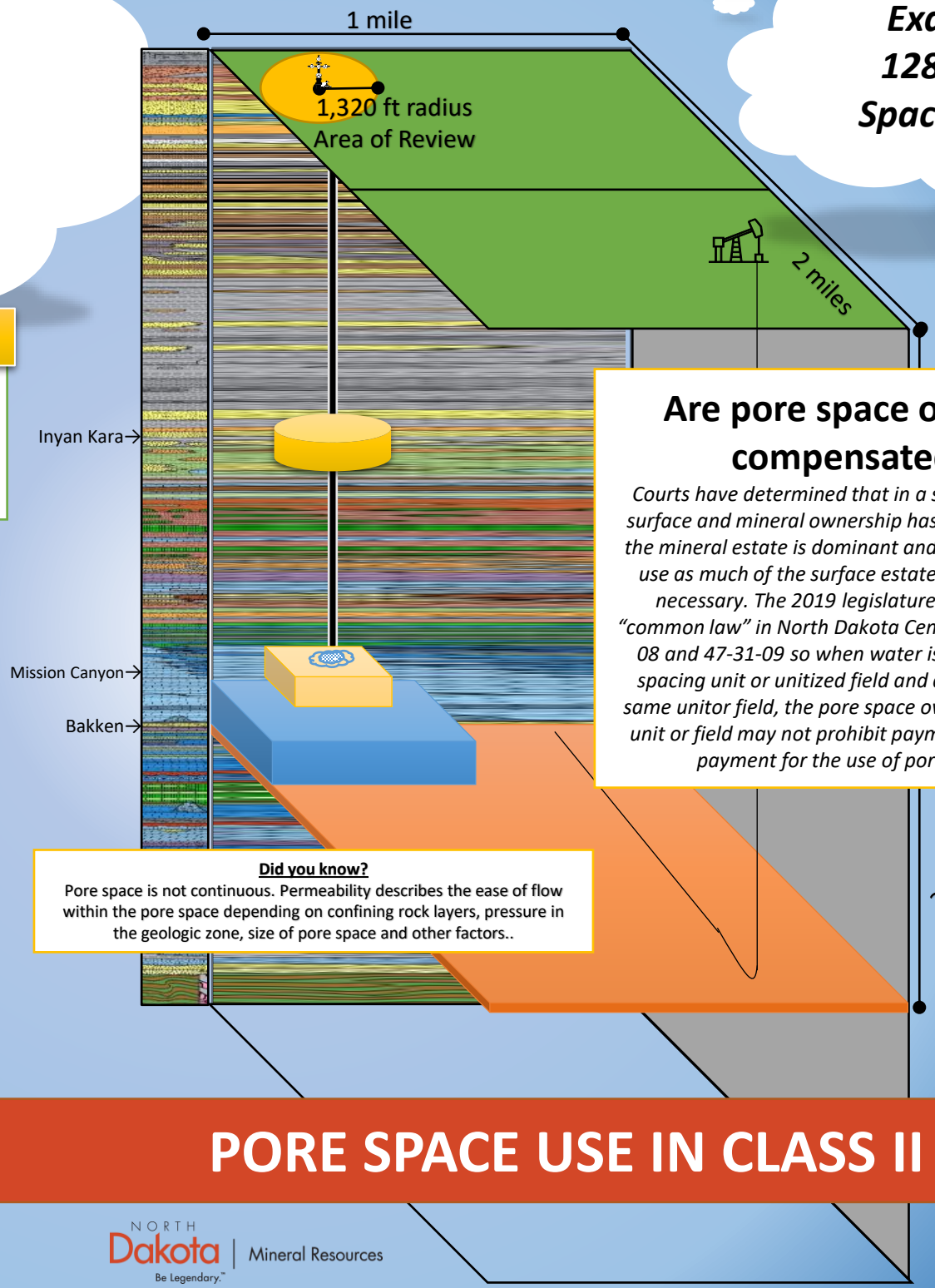
The formation's pressure, capacity, and other factors are considered when permitting a Class II disposal well.

Example: In this area of review the Inyan Kara formation creates an average potential for up to 91.4 million barrels of pore space available.

Typical Spacing Unit Sizes

- Bakken – 1280 Acre Spacing Unit
- Formations Deeper than Mission Canyon *(except Bakken)* – 160 Acre Spacing Units
- Mission Canyon - 40 Acre Spacing Unit





Example: 1280 Acre Spacing Unit

Are pore space owners compensated?

Courts have determined that in a situation where surface and mineral ownership has been severed – the mineral estate is dominant and has the right to use as much of the surface estate as reasonably necessary. The 2019 legislature codified this "common law" in North Dakota Century Code 47-31-08 and 47-31-09 so when water is produced in a spacing unit or unitized field and disposed in the same unitor field, the pore space owner within that unit or field may not prohibit payment or demand payment for the use of pore space.

Did you know?

Pore space is not continuous. Permeability describes the ease of flow within the pore space depending on confining rock layers, pressure in the geologic zone, size of pore space and other factors..

PORE SPACE USE IN CLASS II WELLS

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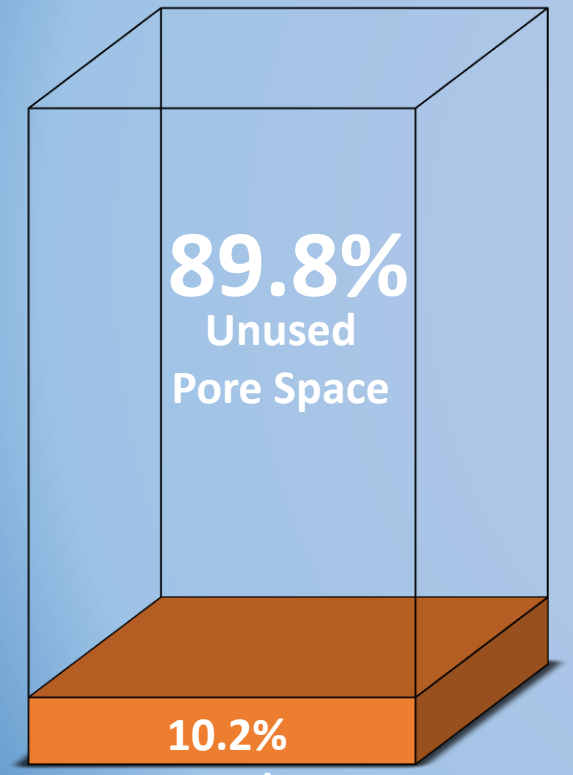
How much pore space is used in Class II disposal wells?

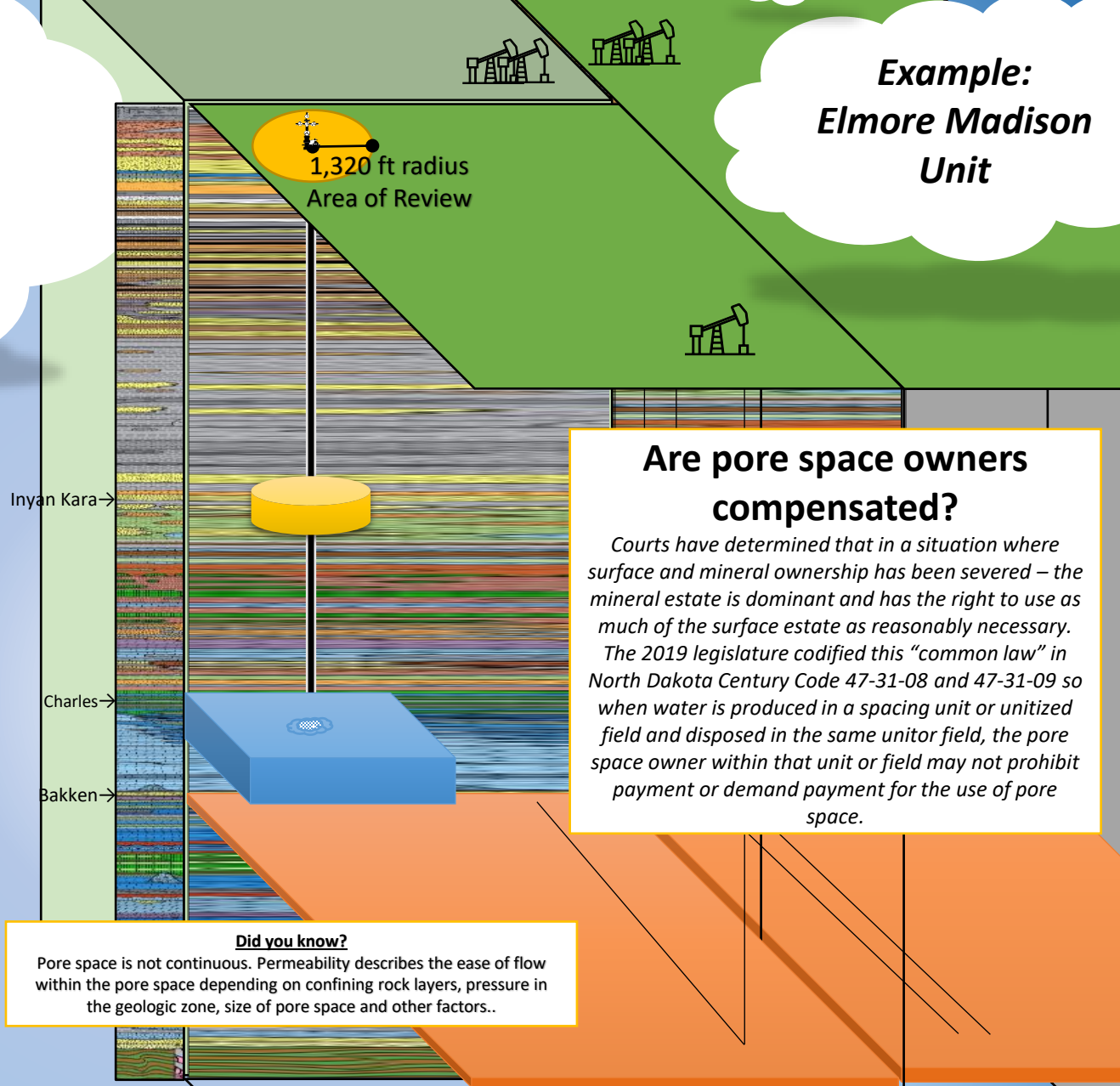
Regulation requires that 1,320 foot (1/4 mile) radius area of review be conducted.

The formation's pressure, capacity, and other factors are considered when permitting a Class II disposal well.

Example: In the Elmore Madison Unit's area of review the Inyan Kara formation creates a potential for up to 58.5 million barrels of pore space available.

Elmore Madison Unit





Example: Elmore Madison Unit

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PORE SPACE USE IN CLASS II WELLS

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Class II UIC Well

Regulated by North Dakota Oil and Gas Division

Injection of fluids associated with oil and gas production; Saltwater disposal, enhanced oil recovery, and hydrocarbon storage

Class III UIC Well

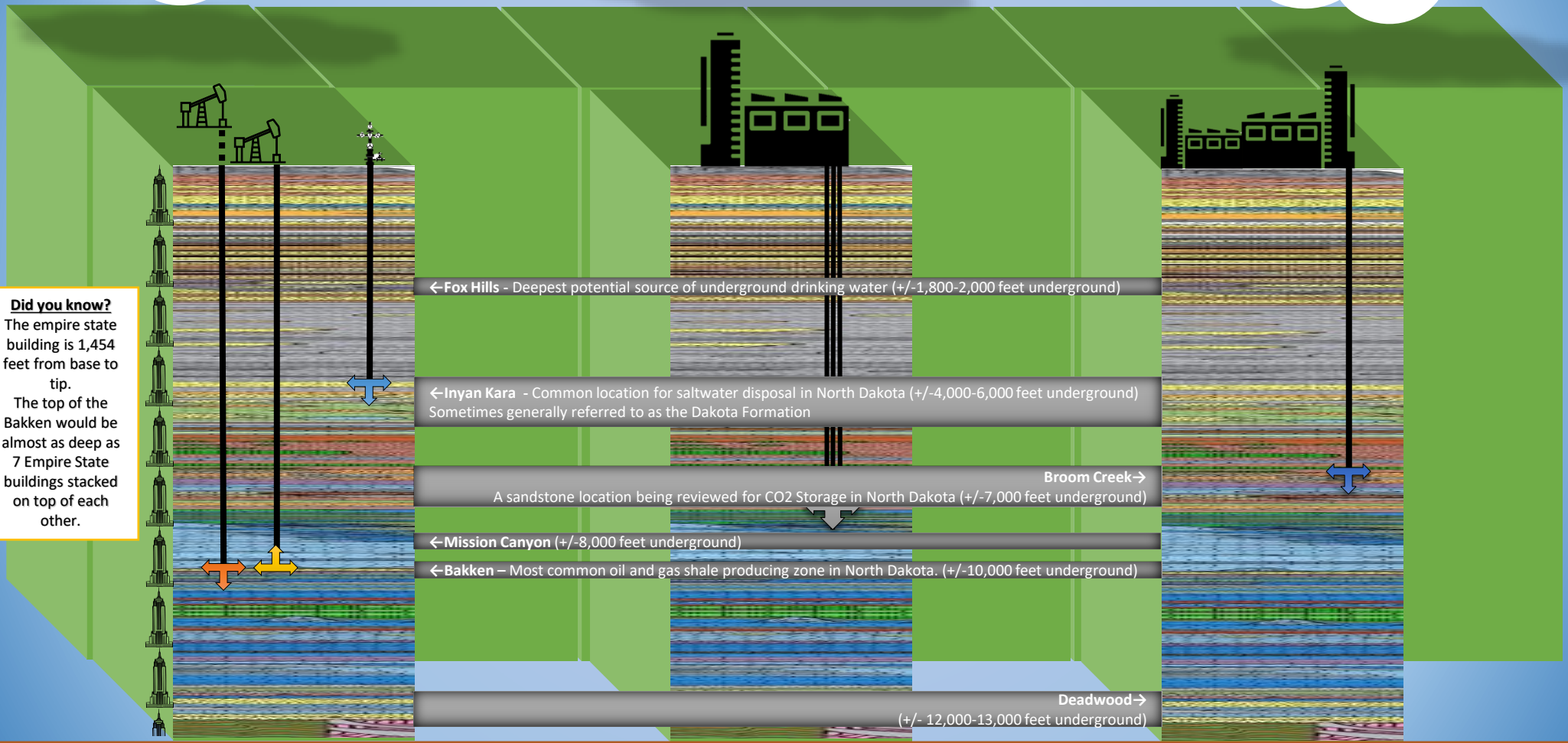
Regulated by North Dakota Geological Survey

Injection of fluids to dissolve and extract minerals (i.e. solution mining for creation of salt caverns)

Class VI UIC Well

Regulated by North Dakota Oil and Gas Division

Injection of carbon dioxide for long-term storage. (i.e. Geologic storage of carbon dioxide)



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TYPES OF UIC WELLS REGULATED BY ND OIL AND GAS

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