Railroad Commission of Texas

Public GIS Sites

Energy Industry Experience

811 Equivalent: Texas Energy, Mining & Groundwater

James Harcourt P.G., Jared Ware

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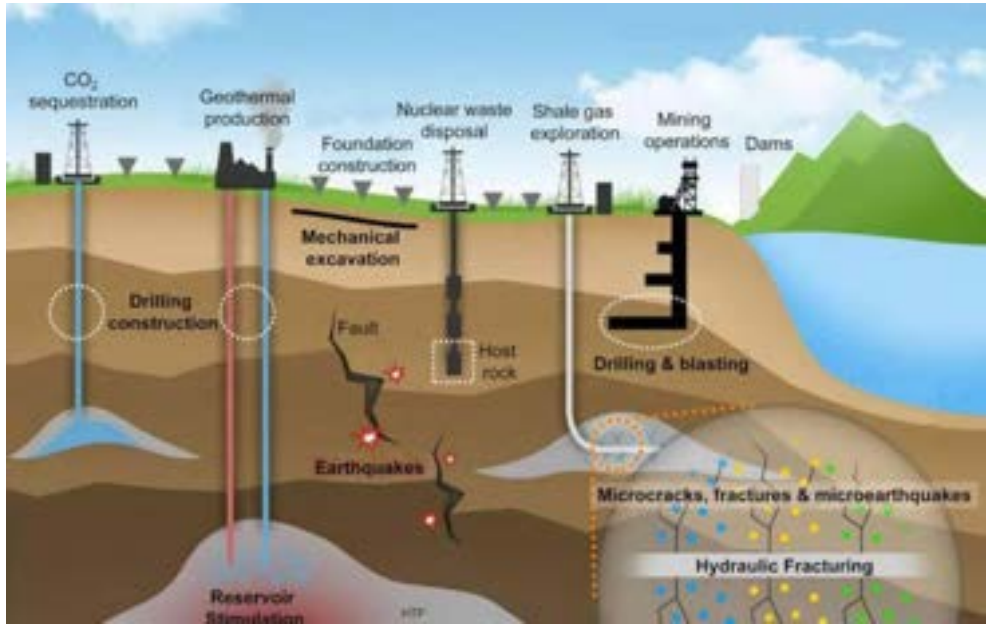


Who is the Railroad Commission?

1891: RRC Created with Jurisdiction over Railroads (Oldest Texas Regulatory Agency)
- Operational Safety, Terminals, Wharves, Express Companies
- Equality in Freight Charges (Oil & Gas Transported by Train)
- Standard Oil Used Freight Charges to set World Oil Prices (J.D. Rockefeller)

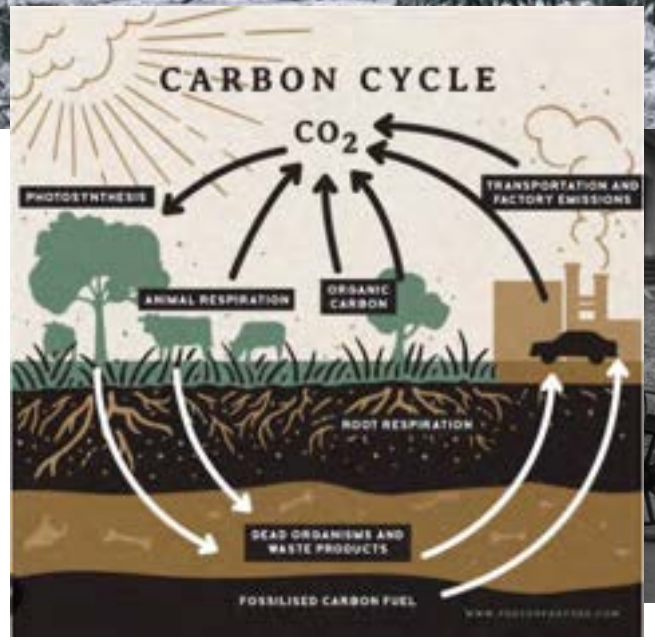
1917: Texas Highway Department Established (TxDOT)
- Build and Maintain Roadways
- Responsible for Public Transit and Safety
- Regulation of Railroads Transition to TxDOT Begins

1919: Oil & Gas Conservation Law Passed (Severance Tax Established!)
- RRC given jurisdiction to regulate Oil & Gas Production
- RRC Set World Oil Prices from 1919 to 1975!

1975: Texas Surface Mining and Reclamation Act
- RRC regulation exploration and surface mining of coal, lignite, and uranium

2005: Last Rail Division (Safety) Passed to TxDOT
- RRC Oil & Gas, Pipelines, Surface Mining

2024: Statutory Authority over Geothermal & Carbon Sequestration

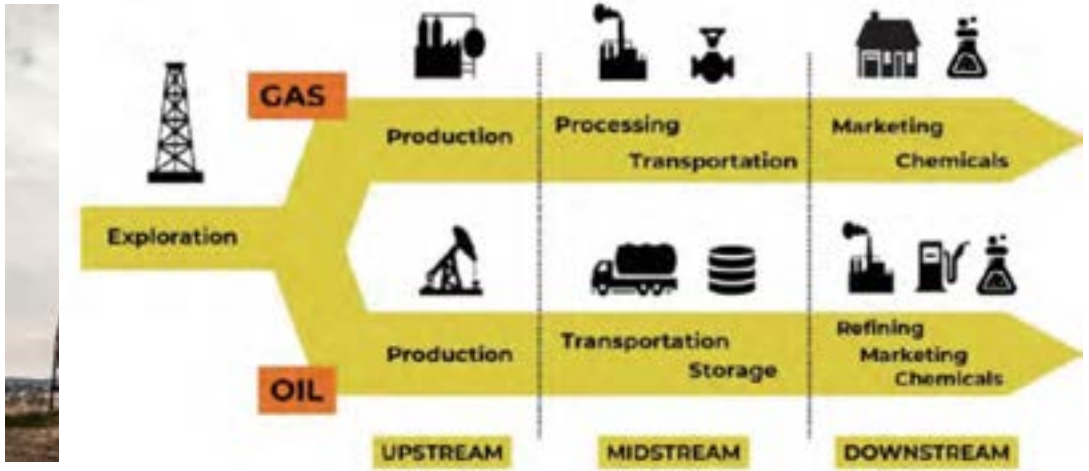


Definitions: Engineering, Production, Geology

Engineering - Science & Technology About design, building, and Use

- Engines, Machines, & Structures
  - Wells, Pipelines, Mines, Other Structures

Production – Processes for Extracting, Processing, Quantifying, Transporting



Business Metrics of Oil & Gas

- Quantities Extracted
- Waste Management
- Authority
- Ownership
- Permits
- Transportation

Geology – The science that deals with the earth's physical structure

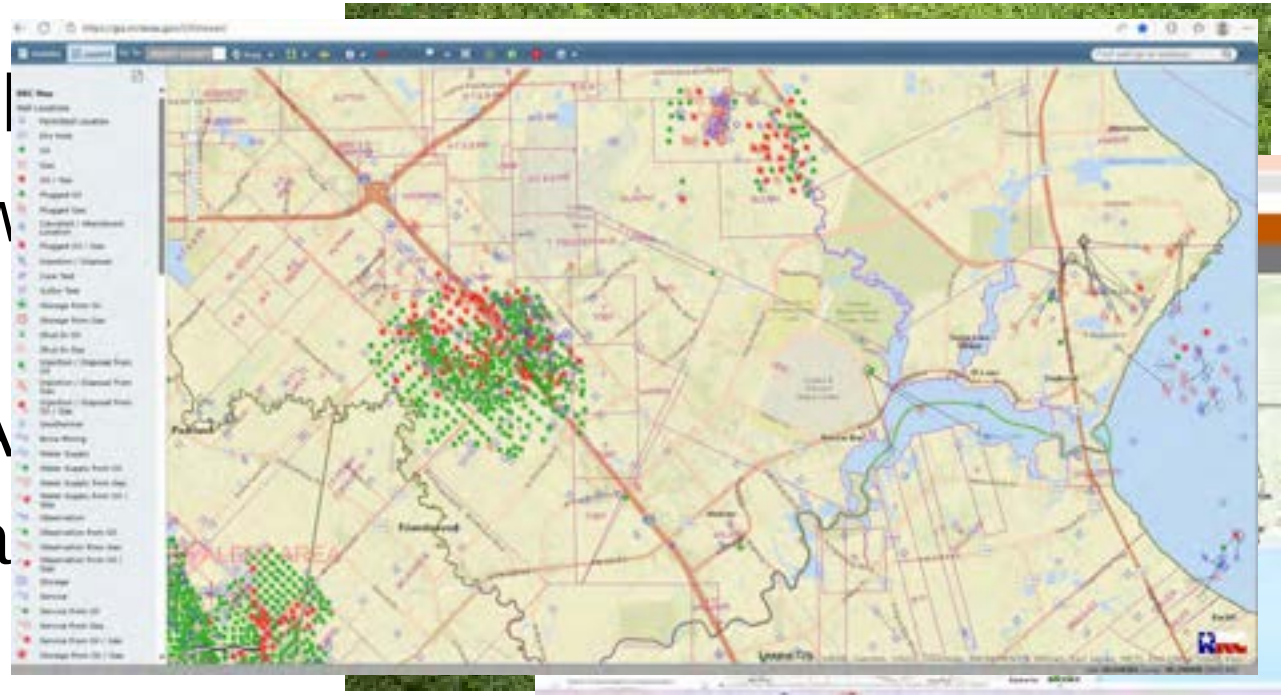
- Rock Chemistry, History, Processes, and Forces that Act on Rocks

GIS 811 for Texas Energy and Groundwater

❖811 GIS Equivalent for Energy and Groundwater

1) Public GIS Viewer
   – Location of Regulated Oil & Gas Field Assets
   – Engineering, Production, & Permitting Information

2) Drilling Insight and Casing I
   – Groundwater Depths (Logs, w
   – All Types Wells and Mines
   – Seismicity & Over Pressure A
   – Geologic Hazards (Faults, Sa



Oil and Gas GIS Viewers…Make It Personal

Downtown NE Houston HWY 610

- Plugged Oil & Gas Wells
- Marked 12 out of 40
- 20 Houses, 2 Apartment Bldg.
- 1 High School
- 3 Retail Businesses

Downtown SE Houston HWY 610

- Salt Piercement Structure
- ~ 100+ homes, Apart.,& businesses
- 1 Kids Baseball Park
- 1 Nursing Home

San Antonio

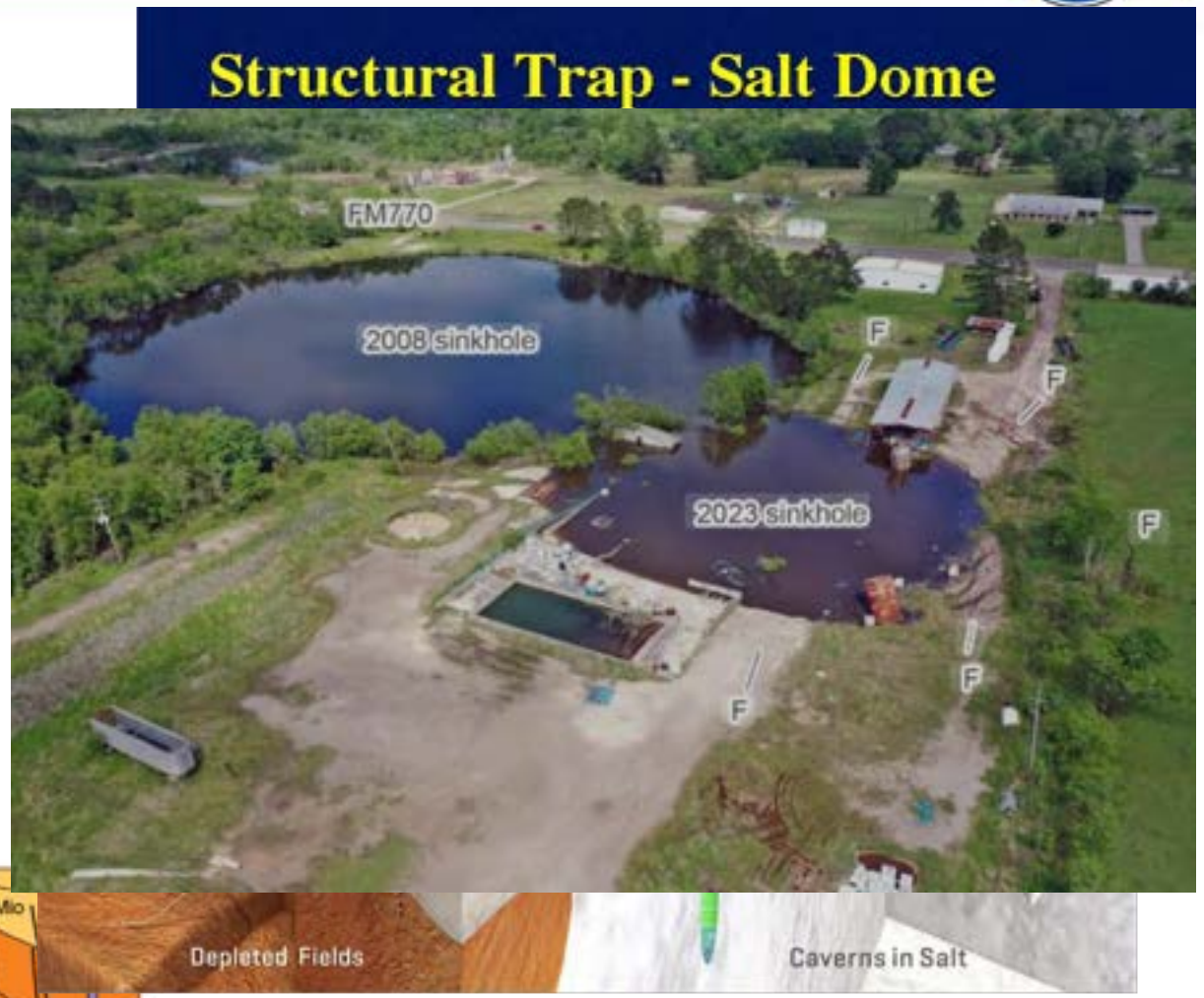
- Active Faults
- Many wells under, houses, & streets

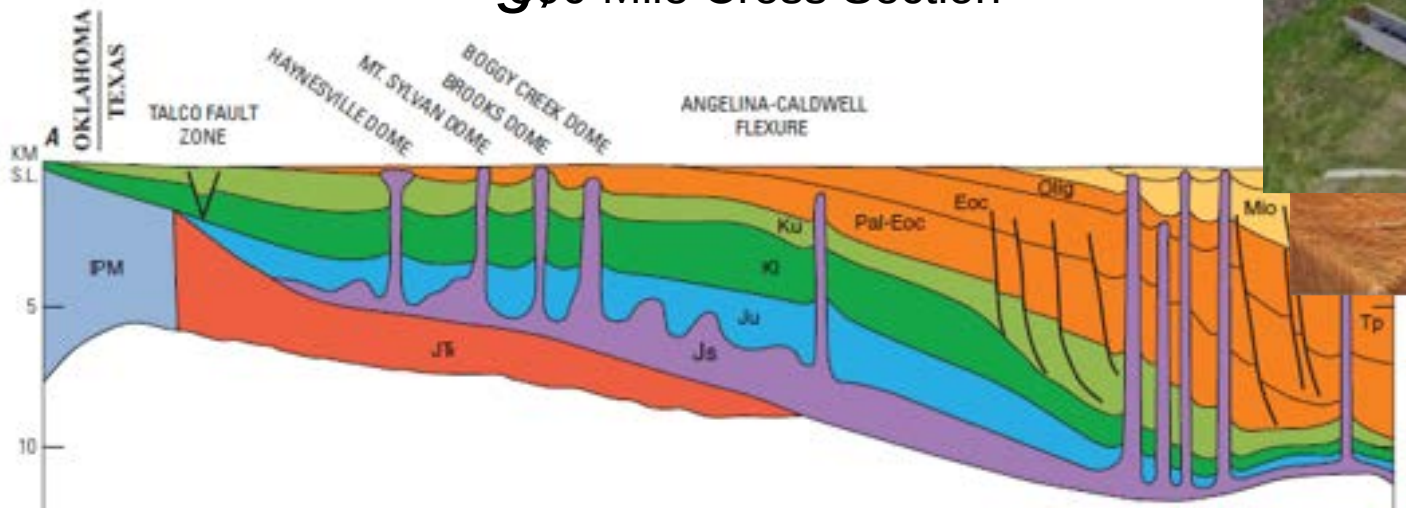
More to O&G Engineering Than You Think

- The Product is Fluids = Liquid (Oil, Water) & Gas
- Production is Taking Fluids Out
  - Engineering Equipment Required
  - Disposal of Waste also Required
- Putting Fluids Back In The Ground
  - 1 BBL Oil & Gas to 10 BBL Produced Water
  - 30% of O&G Wells are Injection
  - Enhanced Oil recovery (EOR)
  - Disposal
  - Reuse
- Many Other Types of Industrial Injection
  - Industrial Waste
  - Solution Mining
  - Geothermal Energy
  - Carbon Sequestration (Storage)

More to O&G Geology Than you Think

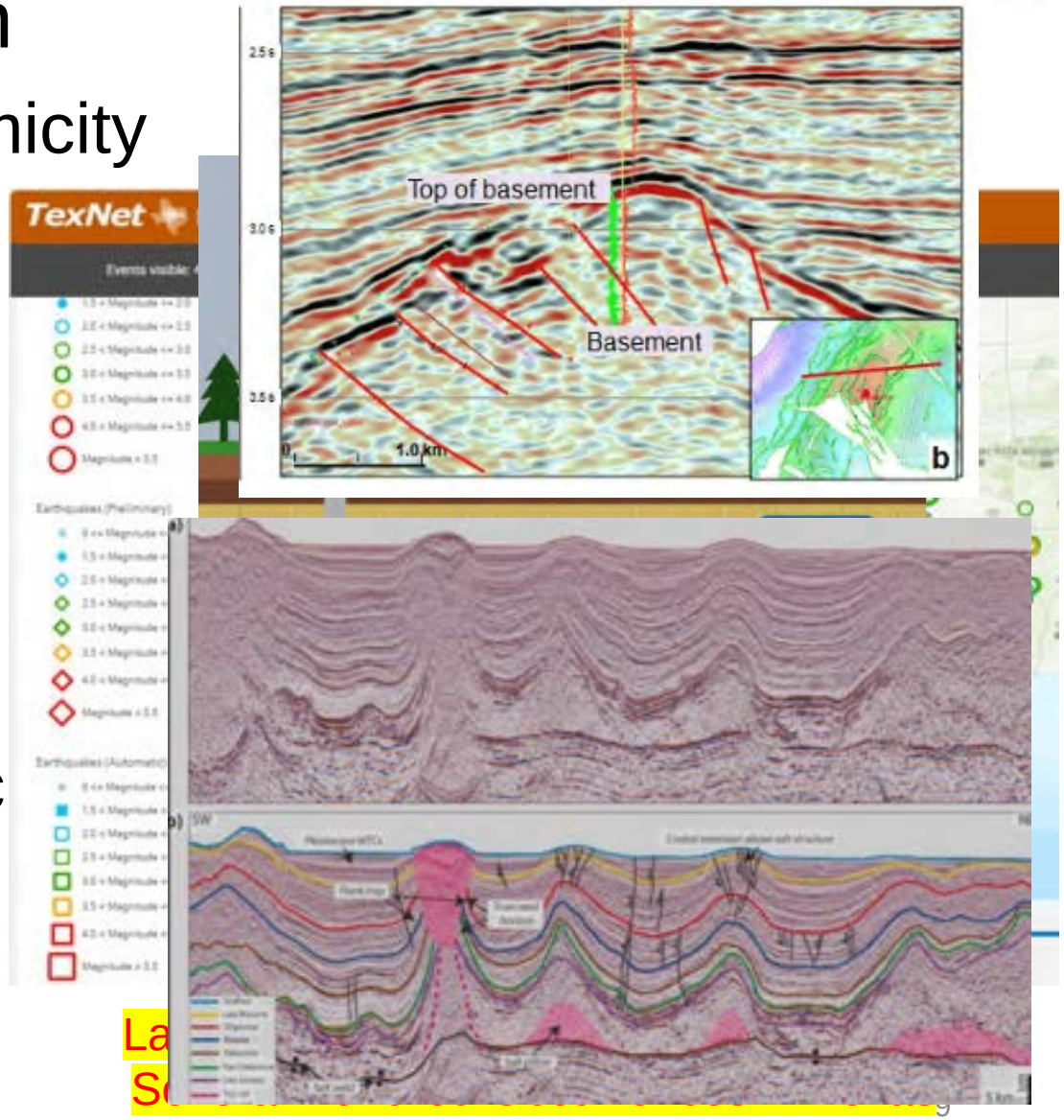
- Salt Piercement Structures
  - Production (Oil, Salt, Sulfur)
  - Several Miles Deep & Wide
  - Storage (Oil, Gas, Chemicals)
  - Can be Close to Surface
- Some Potential for Hazard
  - Faulting, Dissolution





Induced Seismicity (Anthropogenic)

- Deep Underground O&G Injection
  - Evidence of Injection Induced Seismicity
  - Faults deeper then 1 Mile
- Hydro-fracking Operations
  - Infrequent Cause of Seismicity
  - Often Incorrectly Blamed
- Pathway Deep Faults & Small Bloc
  - Fluid Volumes & Pump Pressures
  - Pore Pressure

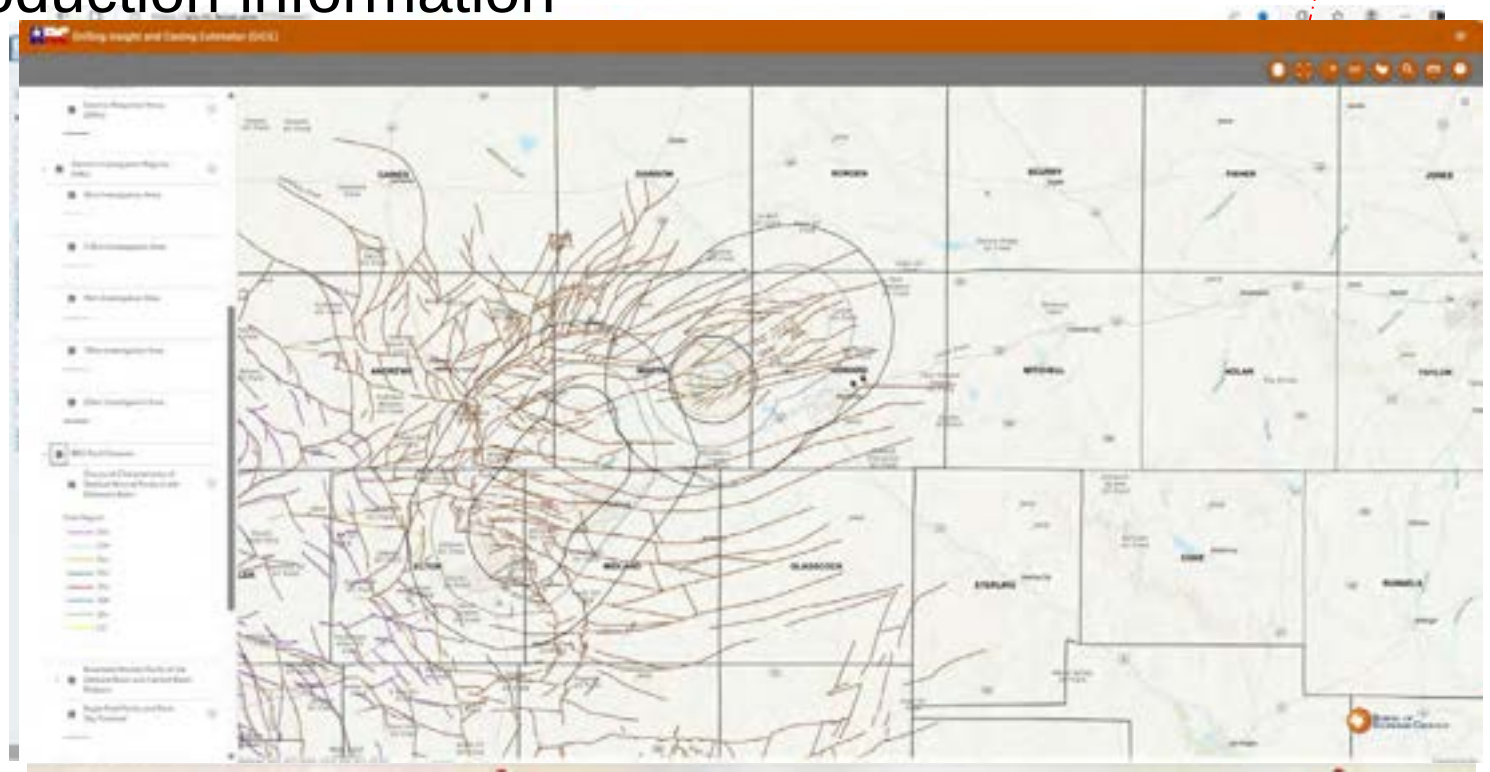


Back to Public GIS Viewer & DICE Site

Public GIS Viewer (Engineering and Production Data)

- Inventory of Regulated Oil Field Assets *(Data Belongs to RRC)*
- Spatial representation of Texas RRC regulated assets
  - Access to 95% of all electronic database information at RRC
  - Hyperlinks to business and production information
  - Multiple Asset Layers

What is this?



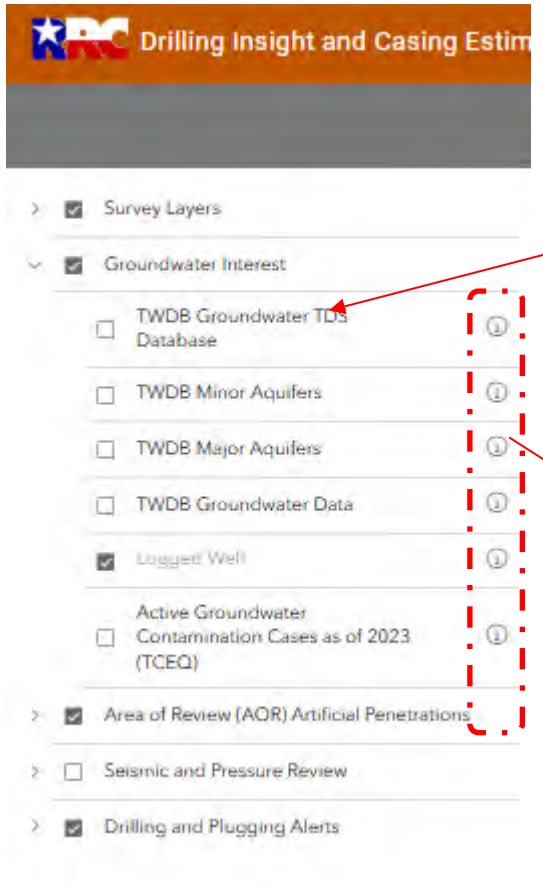
DICE (Drilling Insight) (Geology)

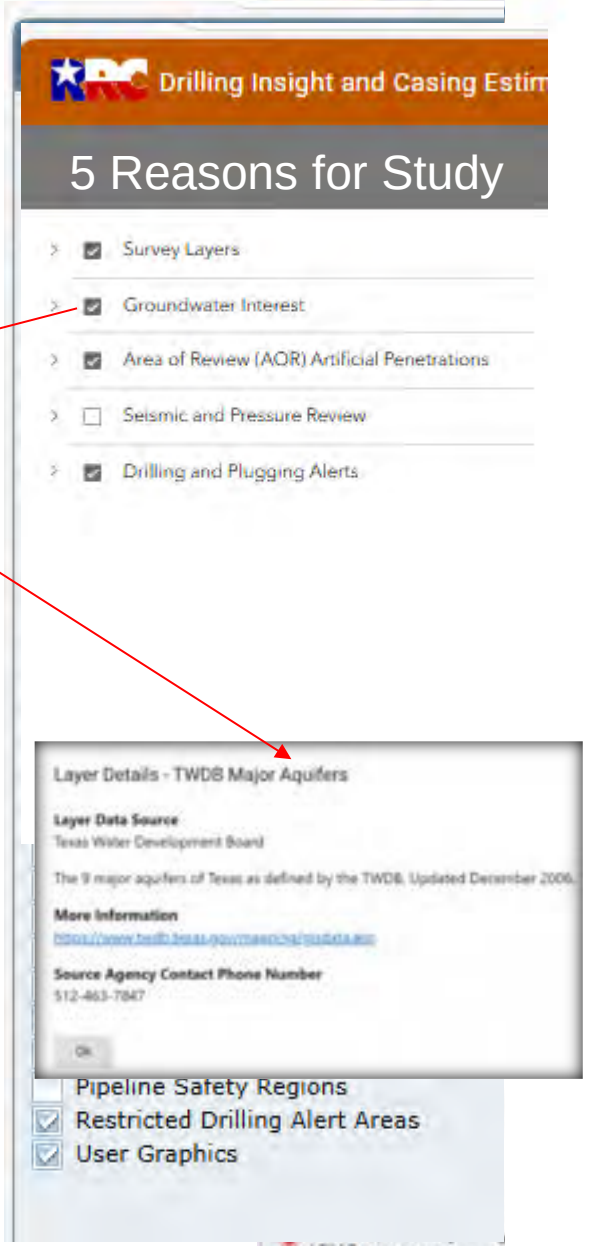
- Drilling Alerts
  - Groundwater Depths
  - Seismicity layers (Review Areas)
  - UT BEG Owned & Operated

Hint*

Finding Public GIS & DICE Layers

- Public GIS Viewer Layers *[Titled **Visibility** at upper right]*
  - Regulated engineering assets
  - Wells
  - Pipelines
  - Clean-up sites
  - Extensive Symbology [Titled **Legend**]
  - RRC responsible for Data Accuracy





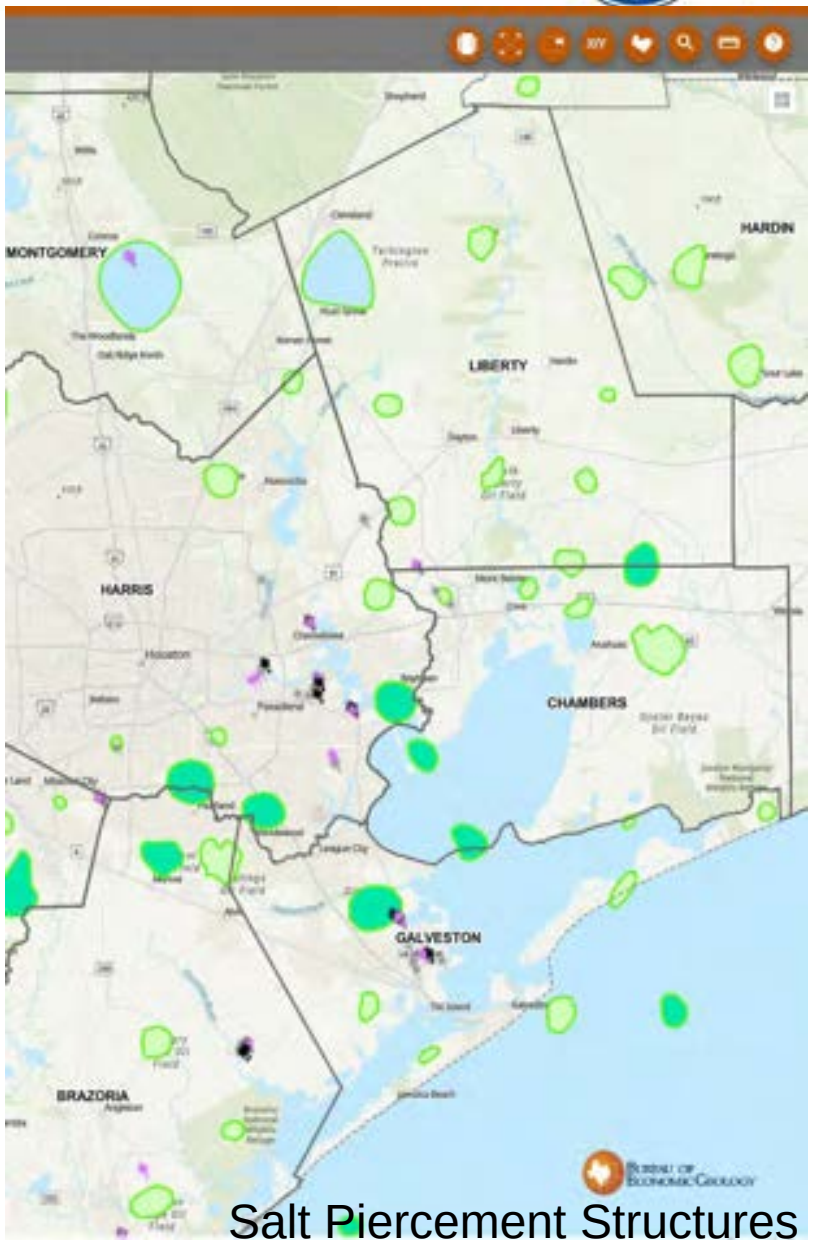
- DICE layers (Drilling Insight Casing Estimator)
  - Survey
  - Groundwater Depths
  - (AOR) Artificial Penetrations (Industrial Assets)
  - Seismic Response & Investigation areas
  - Drilling & Plugging Alerts

❖ Multiple Agency & Published Data Sets
❖ Citing, Update Frequency, Accuracy
❖ BEG & Other State Agencies Responsible for Accuracy

Two Sites with Different Types of GIS Data

1. Public GIS Viewer - *Engineering and Production Data*
   - Regulated RRC Asset Engineering Information
   - Production & Permitting Information
   - 95% of all RRC Engineering and Production Information
   - Extensive Rabbit Holes of Business & Permitting Data
   - Data Limited to Railroad Commission Records Only

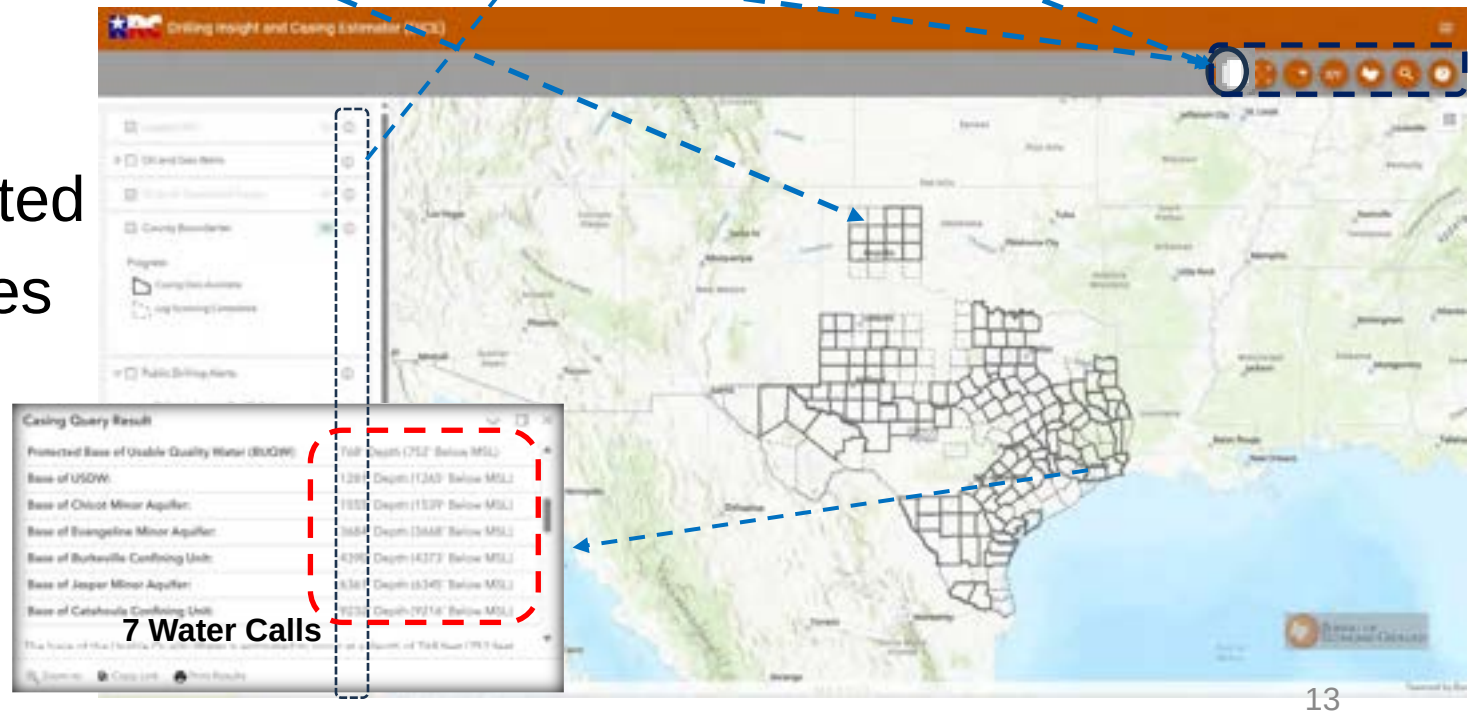
2. Drilling Insight & Casing Estimator (DICE)
   - Geologic and Hydrogeologic Data
   - Known Casing Depths (no water research required)
   - Groundwater Depth Interpretations (Peer Reviewed)
   - Geologic Drilling Alerts
   - Published Peer Reviewed Geologic Hazzard Data
   - Data from Multiple Agencies and Published Work



Salt Piercement Structures

DICE Drilling Alerts Additional Detail

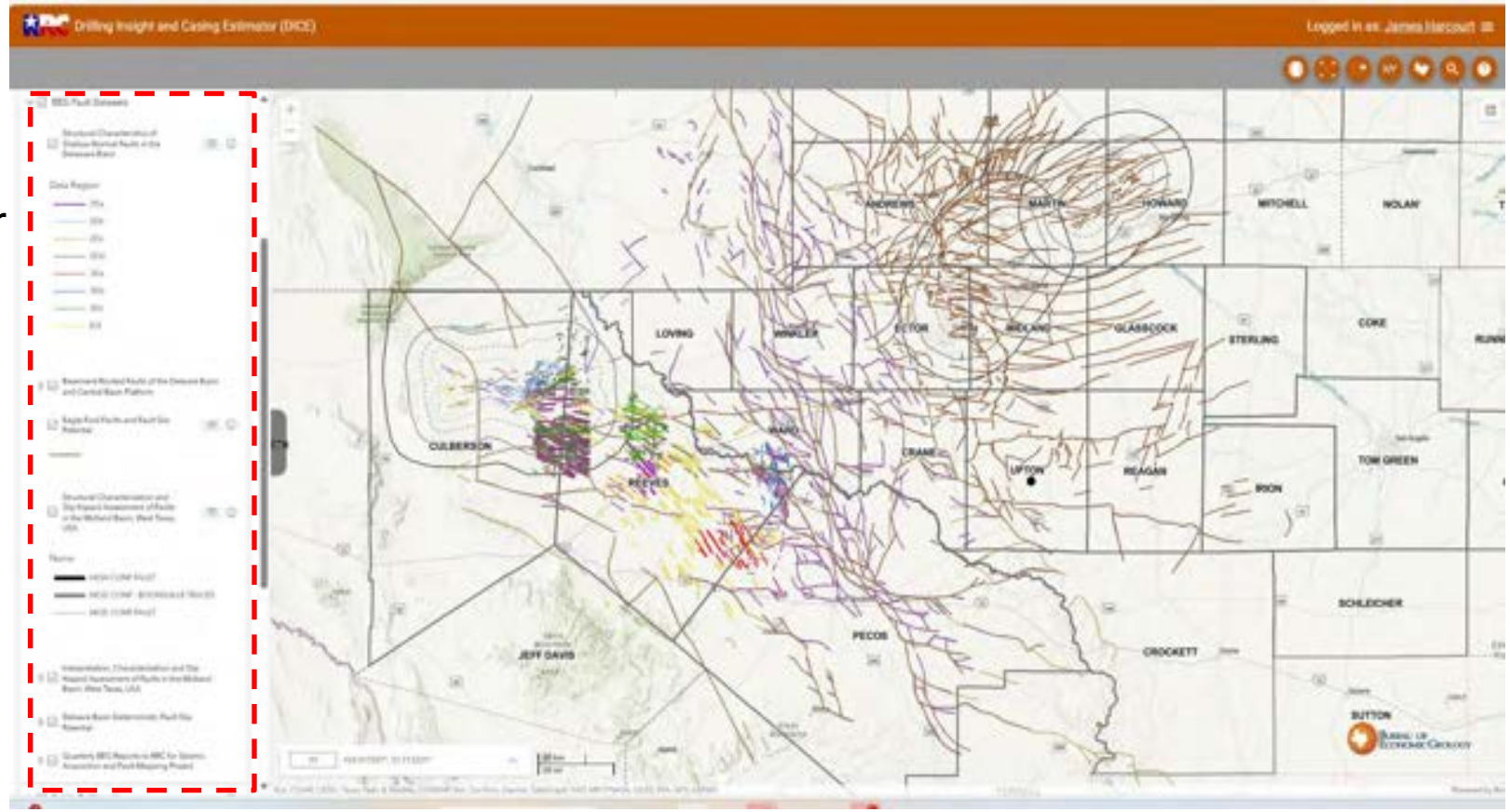
- Geologic, Hydrogeologic, Drilling Alerts & Hazar
  - Salt Piercement Structures
  - Known Casing Depth Area
- Comprehensive Groundwater Protection Inform
  - Interpreted Counties (dark)
  - Scanned Counties (dashed)
  - 90% O&G Counties Interpreted
  - Priority is Gulf Coast Counties
- Data Source Identification
- Query Tools
  - Roll Curser for Descriptions



How Geologic Reviews Protect the Environment

- Setting Surface Casing and Plugging
  - Protection of Groundwater
  - Sudden Depth Change
- Plugging Alerts SWR 14
  - Protection of Groundwater
  - Caustic Formations
  - Friable Formations (Salt)
  - Overpressure formations
- Seismicity Reviews (AOR's)
  - Protect Structures
  - Protect O&G Reservoirs
  - Identify Conductive Faults
  - Identify Problematic Artificial Penetrations
- **Key Alerts**: Salt Formations, Overpressure/Underpressure Formations, & Faults

Seismic Detail is in the Legend



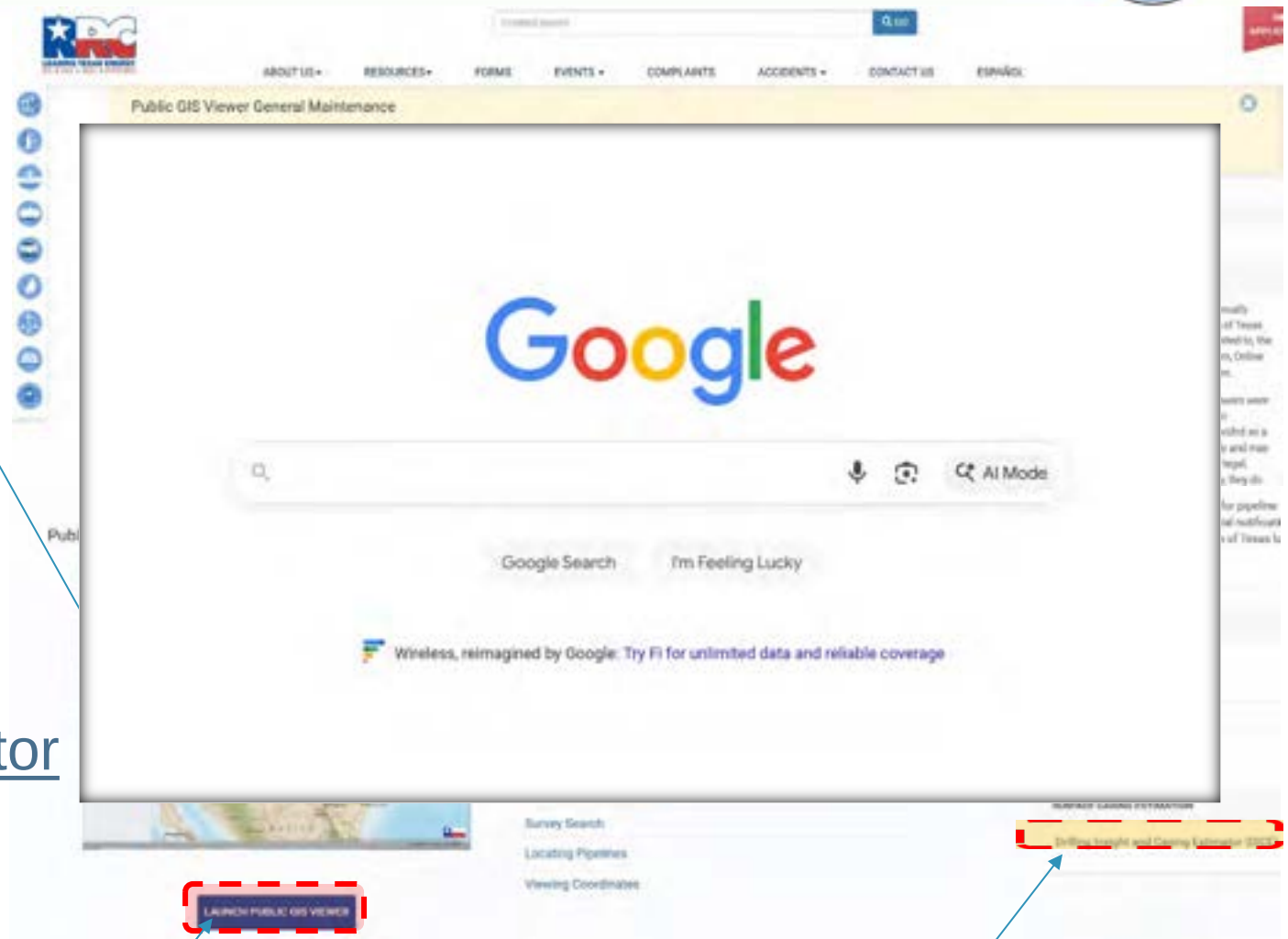
Navigation to Public GIS & DICE Sites

- Standard Search Engines
- Home Page RRC.Texas.Gov
  - Link to GIS Resources
  - Two GIS Resources
  - Public GIS & DICE

- Also Find via Search Engine

  RRC Public GIS Viewer

  Drilling and Insight Casing Estimator



The DICE Site is A Joint Venture

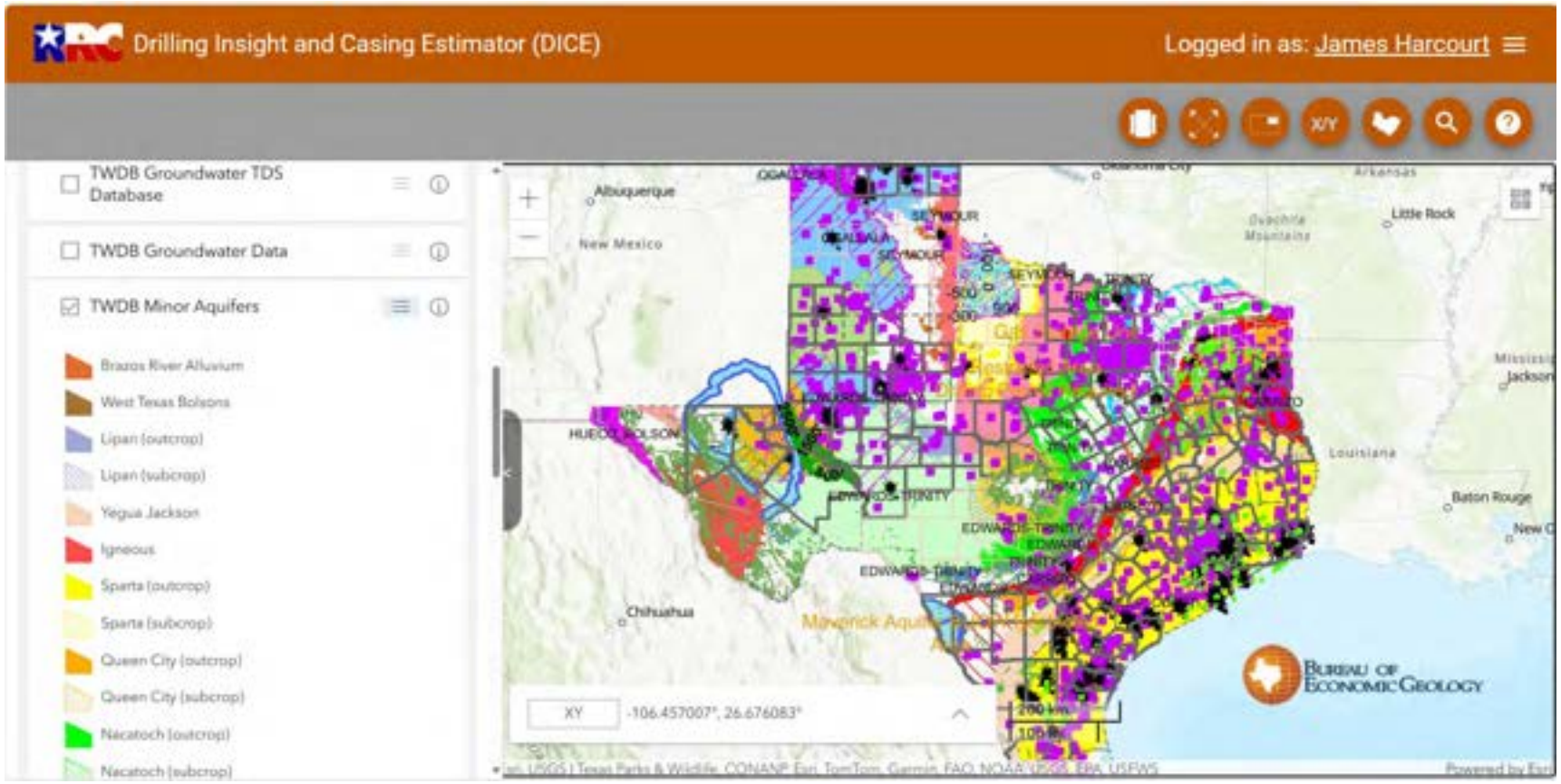
- University of Texas Bureau of Economic Geology (BEG)
  - Hosts Site, Maintains, Updates, and Contributes Content

- Data Sets provided by State & Federal Agencies & Peer Reviewed Data Sets
  - RRC
  - UT BEG
  - TCEQ
  - TWDB
  - EPA

- RRC provides most of the Funding, Creative Direction, Some of the Content
  - TCEQ funded site 2004 – 2011 (1M)
  - RRC is not liable for the accuracy of Non-RRC data sets
  - 225K/Year, 6 Million invested to date by State Agencies

- UT BEG can add most any geologic or hazard information requested
  - What do you want to see?
  - What will help you?

Questions



[RRC Public GIS Viewer]
[Drilling and Insight Casing Estimator]

Questions?

Railroad Commission of Texas

GIS Applications for Permitting and Regulation at the Railroad Commission of Texas

Jared Ware & James Harcourt - Oil & Gas Division

November 6, 2025

Agenda

- **Who we are and what we do**
- **Update on GIS applications and lessons learned**
- **DICE Application “2.0+”**

Railroad Commission of Texas (RRC)

Our mission is to serve Texas by our stewardship of natural resources and the environment, our concern for personal and community safety, and our support of enhanced development and economic vitality for the benefit of Texans.

Commissioner Christi Craddick

Chairman Jim Wright

Commissioner Wayne Christian

Oil & Gas Division - Functions

- **Administrative Compliance**
  - Financial Assurance, Drilling Permits, Well Compliance, Production Audit, and Well Mapping
  - Review applications and issue drilling permits for oil and gas wells & waste haulers

- **Technical Permitting**
  - Underground Injection Control, Geological Advisory Unit, Environmental Permits Unit (waste, recycling, and reclamation) and Special Injection Permits Unit *
  - Class II, V and VI programs

* Class V Geothermal: Special Injection Permit (SIP) Unit

- **Field Operations**
  - HQ & District Offices - "Administrative to Emergencies"
  - Inspections (Compliance, Enforcement, Emergencies and Investigations)
  - Well plugging and cleanup programs

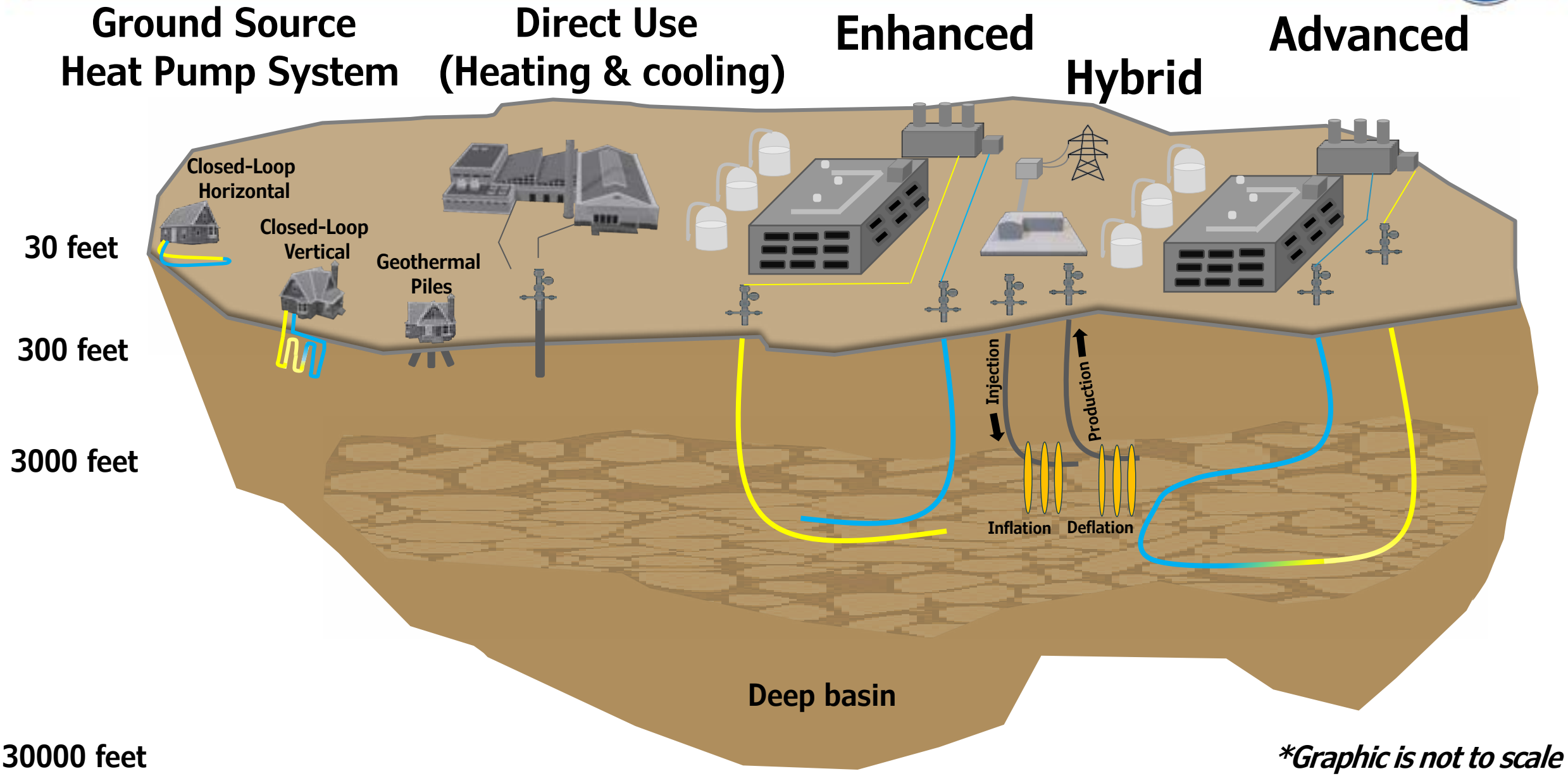
Office 365 & Esri for Regulatory Requirements

- Common applications
  - Most state agencies use Microsoft and associated applications
  - Esri GIS software (ArcPro) is used throughout the public sector
- Effective support
  - Consistent operations & maintenance (O&M) costs
  - Availability of training
- Ease of use
  - Common & recognized data types
  - Sharable & accessible information

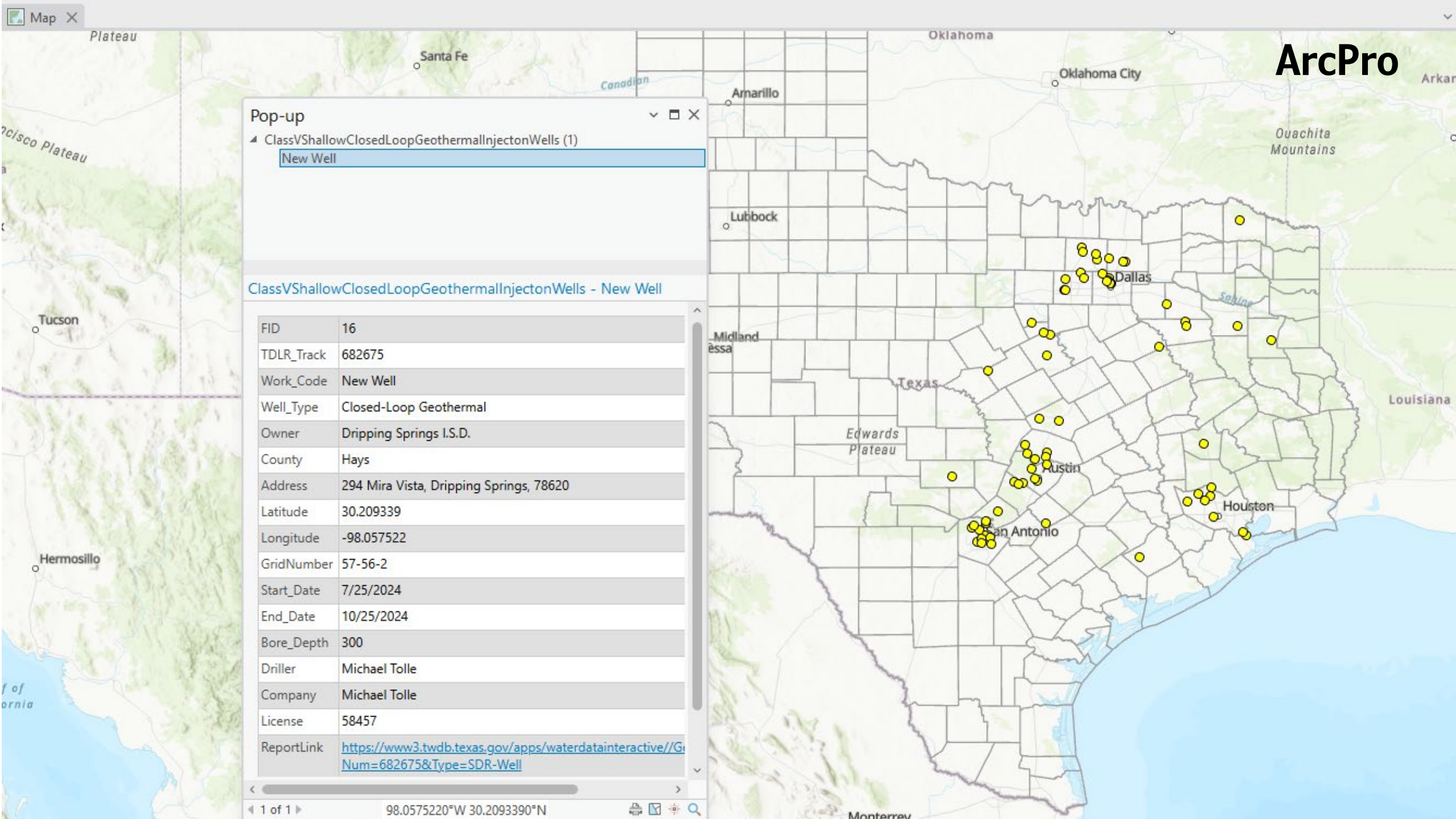
Regulating with Credible Data and Processes

- Enhancing data access and security by connecting ArcGIS Maps for Power BI to ArcGIS Online / Enterprise
- Using Snowflake as a data storage repository and connector
  - ArcPro connects to Snowflake
  - Power BI connects to Snowflake
- Create a single, credible data set – "The Golden Record"
  - Enables multiple applications (ArcPro, Power BI, Google Maps, etc.)
  - Sharable to multiple users (a creator's needs may be different than others)
  - Better version control when used for derivative products
- Enables secure data distribution in dashboards and reports
  - Application licenses required
  - Unique Login/password required
  - Cybersecurity team monitors activity

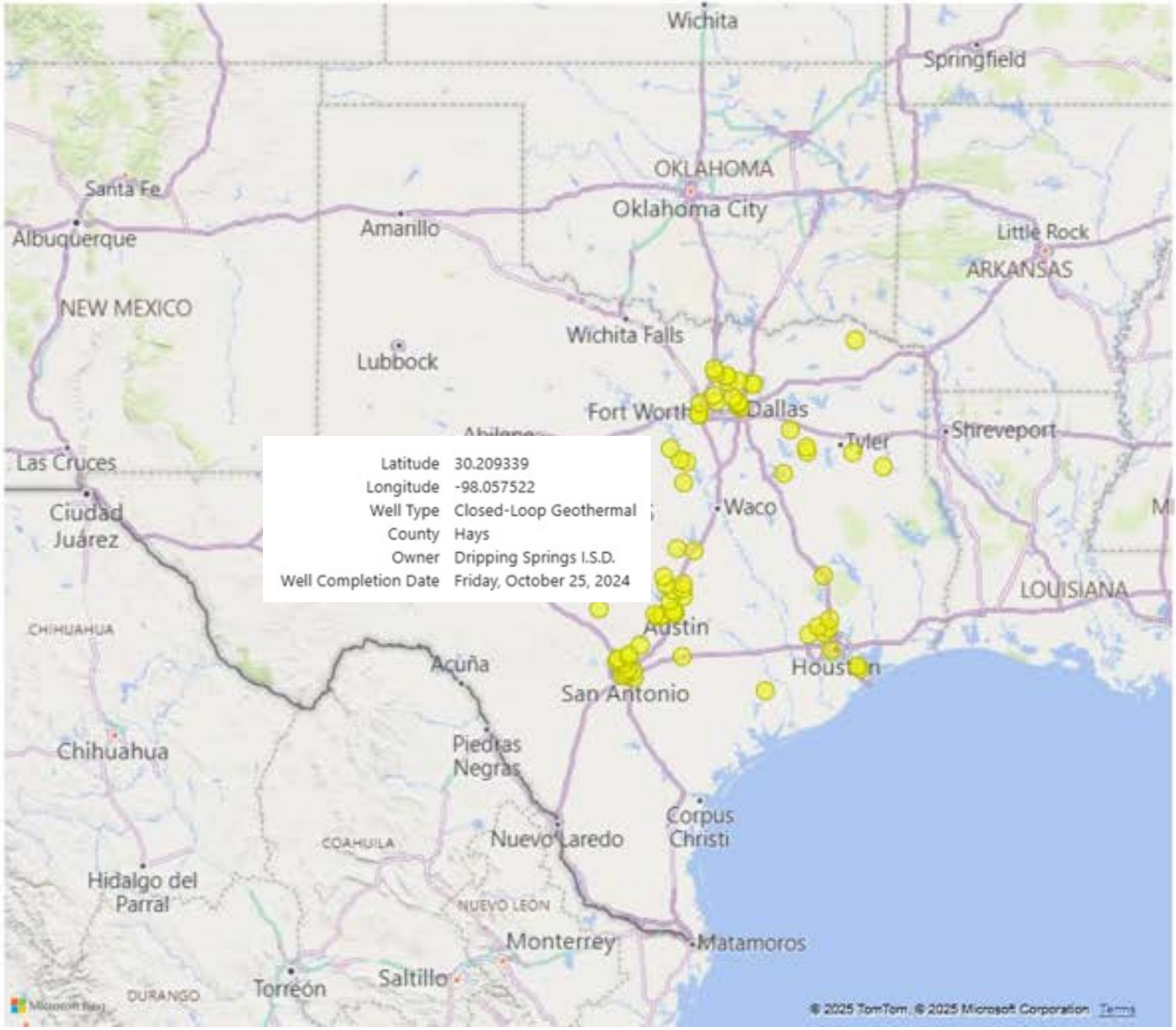
Categories of Class V Geothermal Wells

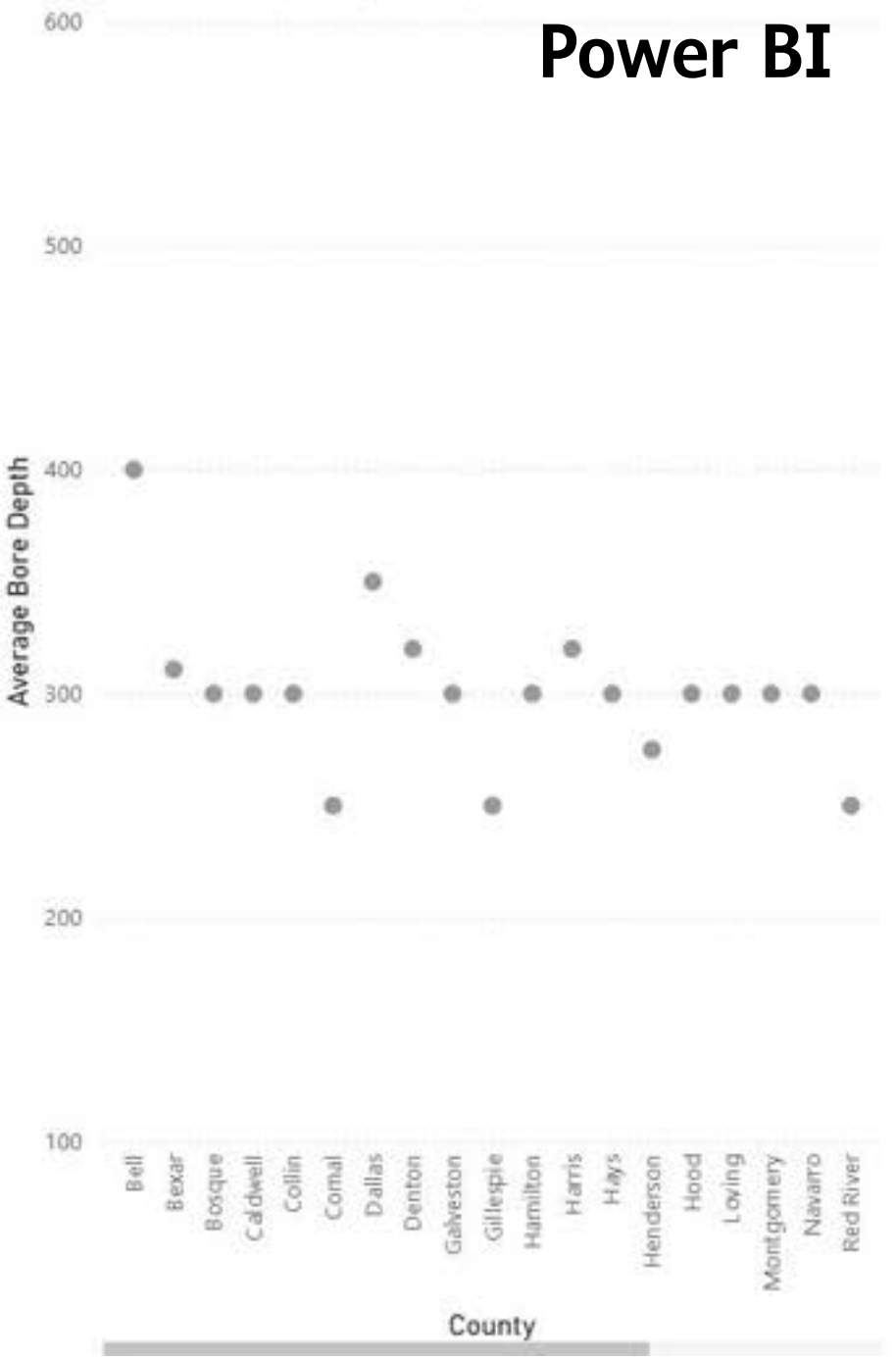


*Graphic is not to scale


Map
ArcPro
Pop-up
ClassVShallowClosedLoopGeothermalInjectonWells (1)
New Well
ClassVShallowClosedLoopGeothermalInjectonWells - New Well
FID 16
TDLR_Track 682675
Work_Code New Well
Well_Type Closed-Loop Geothermal
Owner Dripping Springs I.S.D.
County Hays
Address 294 Mira Vista, Dripping Springs, 78620
Latitude 30.209339
Longitude -98.057522
GridNumber 57-56-2
Start_Date 7/25/2024
End_Date 10/25/2024
Bore_Depth 300
Driller Michael Tolle
Company Michael Tolle
License 58457
ReportLink https://www3.twdb.texas.gov/apps/waterdatainteractive//G
Num=682675&Type=SDR-Well
1 of 1
98.0575220°W 30.2093390°N
Plateau
Santa Fe
Canadian
Amarillo
Oklahoma
Oklahoma City
Ouachita Mountains
Lubbock
Dallas
Midland
Texas
Edwards Plateau
Austin
Houston
San Antonio
Louisiana
Tucson
Hermosillo
Monterrey

Power BI


Class V - Shallow Closed Loop Geothermal Injection Wells (Operational)
Wichita
Springfield
OKLAHOMA
Oklahoma City
Santa Fe
Albuquerque
Amarillo
Little Rock
ARKANSAS
NEW MEXICO
Wichita Falls
Lubbock
Fort Worth
Dallas
Tyler
Shreveport
Las Cruces
Ciudad Juárez
Waco
LOUISIANA
Austin
CHIHUAHUA
Acuña
Houston
San Antonio
Chihuahua
Piedras Negras
Corpus Christi
COAHUILA
Nuevo Laredo
Hidalgo del Parral
NUEVO LEON
Monterrey
Matamoros
Torreón
Saltillo
DURANGO
Latitude 30.209339
Longitude -98.057522
Well Type Closed-Loop Geothermal
County Hays
Owner Dripping Springs I.S.D.
Well Completion Date Friday, October 25, 2024
© 2025 TomTom, © 2025 Microsoft Corporation Terms


Average of Bore Depth by County
Average Bore Depth
600
500
400
300
200
100
Bell
Bexar
Bosque
Caldwell
Collin
Comal
Dallas
Denton
Galveston
Gillespie
Hamilton
Harris
Hays
Henderson
Hood
Loving
Montgomery
Navarro
Red River
County

Lessons Learned

- **Requirement – Data – Application**
  - Is the data only for a permitting requirement or will it be used in other activities?
  - Is it better to have a large "one size fits all" database or a series of smaller subsets in a single repository?
  - What are the applications that can address the requirement?
- **Test the data the way you use and may use the data**
  - Is it accessible to the right users across multiple platforms or processes?
  - Is it scalable or do data storage limitations, constraints, or restrictions exist?
  - Is it usable in every application?
- **Cartographic principles**
  - Graphics > Tables > Text (See it then read it)
  - Symbols, colors, text and size (Strive for clarity and consistency)
  - Limit visuals to the regulated requirement (Too much is more than enough)