1.0 PROJECT NARRATIVE
40 CFR 146.82(a)

BONANZA SEQUESTRATION

Facility Information

Facility name: Bonanza BioEnergy

Facility contact: Aaron Klein
Conestoga Energy Holdings, LLC | Vice President of Strategic Projects
[redacted]

Well name: Doll INJ-1

Well location: FINNEY COUNTY, KANSAS
[redacted]

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List of Abbreviations

Abbreviation	Description
°	Degree
µm	Micrometer
^{13}CR	Corrosion-resistant chrome
2D	Two-dimensional
3D	Three-dimensional
ACZ	Above confining zone
AoR	Area of Review
Bbls	Barrels
BOP	Blowout preventor
BOPE	Blow out prevention equipment
BTC	Buttress threaded and coupled
C	Celsius
CBL-VDL	Cement bond log – variable density log
CCS	Carbon capture and storage
CFR	Code of Federal Regulations
CO_2	Carbon dioxide
DAS	Distributed Acoustic Sensing
DOE	Department of Energy
DOT	Department of Transportation
DRM	Dynamic Reservoir Model
DTS	Distributed Temperature Sensing
EOD	Environment of deposition
EPA	Environmental Protection Agency
ERRP	Emergency and Remedial Response Plan
F	Fahrenheit
FEMA AE	Federal Emergency Management Agency Adverse Effects
FMEA	Failure, Mode, Effect, Analysis
ft	Feet
FMI	Formation micro-imager
FO	Fiber optic
Gal	Gallon
GPM	Gallons per minute
ID	Identification
KCl	Potassium chloride
lb	Pound
LCM	Lost circulation material
LTC	Long threaded and coupled
MD	Measured depth
MDKB	Measured depth below Kelly Bushing
mD	Millidarcy

MDT	Modular Formation Dynamics Test
mg	Milligram
MI	Move-in
mi	Mile
MICP	Mercury Injection Capillary Pressure
MIT	Mechanical integrity test
mL	Milliliter
MMscf	Million standard cubic feet
Ms	Millisecond
mtpy	metric tonnes per year
MVA	Monitoring, Verification, and Accounting
N/A	Not applicable
NACE	National Association of Corrosion Engineers
NaCl	Sodium chloride
NELAP	National Environmental Laboratory Accreditation Program
NETL	National Energy Technology Laboratory
NMR	Nuclear magnetic resonance
MD	Measured Depth (measured from KB)
ORP	Oxidation-reduction potential
P&A	Plug and abandonment
PFO	Pressure fall-off
PGA	Peak ground acceleration
PISC	Post-injection site closure
PM	Project Manager
PNC	Pulsed neutron capture
Poz	Pozzolan
ppg	Pounds per gallon
ppm	Parts per million
psi	Pounds per square inch
psig	Pounds per square inch gauge
QA	Quality assurance
QC	Quality control
QASP	Quality Assurance and Surveillance Plan
QR	Quality Representative
RPD	Relative percent difference
RPN	Risk Priority Number
RU	Rig up
SCADA	Supervisory Control and Data Acquisition
SEM	Static Earth Model
SF	Safety factor
SME	Subject matter expert
SOP	Standard operating procedures
SP	Spontaneous potential
SPCC	Spill Prevention, Control, and Countermeasure
SPF	Shots per foot
STC	Short threaded and coupled

STW	Stratigraphic Test Well
TBD	To be determined
TD	Total depth
TDS	Total dissolved solids
TVDSS	True vertical depth sub sea
UIC	Underground Injection Control
USDW	Underground source of drinking water
USGS	United States Geological Survey
VSP	Vertical Seismic Profile
XRD	X-ray Diffraction

1.0 Project Narrative

1.1 Project Background and Contact Information

The primary goal of the Bonanza Sequestration project is to sequester anthropogenic carbon dioxide (CO_2) generated by the Bonanza BioEnergy ethanol plant, located in Finney County near Garden City, Kansas. The project will utilize a single Class VI injection well to safely and securely store CO_2 in deep geologic formations, in full compliance with EPA regulations.

Captured CO_2 will be processed onsite at the ethanol facility and transported via pipeline to the injection site for permanent sequestration. The project injection phase is expected to span [redacted] years, with an average annual injection rate of [redacted] metric tonnes of CO_2.

The capture operations are managed by Bonanza BioEnergy, while Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") will be the operator of the injection site. Conestoga Energy Holdings, LLC serves as the Corporate Owner of both Bonanza BioEnergy and Bonanza Carbon Capture, providing strategic oversight, financial support, and coordination across the capture and storage components of the project.

This permit application is supported by site-specific data collected from the stratigraphic test well (STW), the Doll #1, located within the Area of Review (AoR) (**Figure 1-1**). The Doll #1 STW well will be converted to the injection well (Doll INJ-1) during the construction phase. Extensive subsurface characterization including [redacted], was conducted to inform geologic suitability of the site (**Figure 1-2**). These data were incorporated into a geostatistical static earth model (SEM) and used to perform dynamic reservoir simulations (Permit Section 2.0 – AoR and Corrective Action Plan).

[redacted]

Figure 1-1: Map of Bonanza Sequestration project showing AOR, injection well (Doll INJ-1), Deep Monitoring Well (DMW-1) and Above Confining Zone (ACZ-1) monitor well, conceptual location of seismicity stations. Also shown are all known wells within the AOR.

[redacted]

Figure 1-2: Schematic summary illustrating the stratigraphic data collected in the STW. For a comprehensive list of well logs conducted at the Doll #1 STW, refer to Section 1.2.5.

1.1.1 Project Goals

The Bonanza Sequestration project is designed to permanently store CO_2 emissions generated by ethanol production at the Bonanza BioEnergy facility in Garden City, Kansas. In this project, Bonanza Carbon Capture plans to:

- Utilize the existing CO_2 capture facility located at the Bonanza BioEnergy ethanol plant
- Construct infrastructure to transport CO_2 from the ethanol plant to the designated injection site
- Convert the Doll #1 STW well to CO_2 injection well (Doll INJ-1) in compliance with Class VI requirements
- Implement a comprehensive monitoring program to assess potential impacts to the lowermost Underground Source of Drinking Water (USDW) located above the injection interval
- Conduct post-injection site care (PISC) activities to verify the stability of the CO_2 plume, confirm that storage formation pressure is declining toward pre-injection levels, validate plume behavior as predicted by computational modeling, and demonstrate non-endangerment of USDWs
- Safely plug all wells and decommission associated infrastructure upon completion of the injection phase

1.1.2 Partners/Collaborators

Key partners and collaborators with the Bonanza Sequestration project are listed in **Table 1-1**.

Name	Role
Bonanza BioEnergy	Ethanol Plant
Bonanza Carbon Capture, LLC	Storage Operator
Conestoga Energy Holdings, LLC	Corporate Owner

Table 1-1: Key project partners and collaborators.

1.1.3 Overview of the Project Timeframe

The overall timeframe of the project, including well drilling, CO_2 injection, monitoring, and closure, is anticipated to be approximately 44 years (**Table 1-2**). This includes:

- [redacted] years for permit approval
- [redacted] year for deep monitoring well drilling, pre-operational testing and issuance of authorization to inject
- [redacted] years of CO_2 injection and monitoring
- [redacted] year for closure
- [redacted] years of post-injection site care (PISC) and monitoring (based on proposed alternative PISC timeframe.)

[redacted]

Table 1-2: Project Gantt Chart.

1.1.4 Proposed Injection Mass/Volume and CO_2 Source

The projected average annual injection rate for this project is [redacted] mtpy CO_2. The composition of the fermentation off-gas has been sampled and analyzed at the intended future capture point and found to have the composition across [redacted] samples as shown in **Table 1-3**. These samples are representative of the dry components of the anticipated injection stream.

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 1-3: CO_2 Stream Composition.

The temperature of the CO_2 stream measured at the compressor discharge ranges from a low of 98.6°F to a high of 138.5°F, with an annual average of 113.8°F. Prior to injection operations, the chemical and physical characteristics of the injectant will be confirmed using appropriate analytical methods (Section 7 – Testing and Monitoring Plan).

[redacted]

Table 1-4: Required CO_2 Stream Composition for sequestration.

1.1.5 Injection Depth Waiver or Aquifer Exemption Requested

No injection depth waiver or aquifer exemption is being sought as part of this permit application.

1.1.6 Other Administrative Information

Table 1-5 provides the administrative information for this Class VI injection well permit application as required by 40 CFR 144.31(e)(1 through 6).

[redacted]

Contacts for State, Federal, and Local Authorities Within AoR		
Type	**Agency Name**	**Phone Number**
Federal	UIC Class VI Program Director (Region 7)	913-551-7992
State	Kansas Commission Corporation (KCC) 266 N. Main St., Ste. 220 Wichita, KS 67202-1513	316-337-6200
Tribes	N/A - None in the AoR	-
Territories	N/A - None in the AoR	-
Local	Garden City Fire Department	516-465-4130
Local	Garden City Police Department	620-276-1300
State	Kansas State Police, Troop E	620-276-3201
Permits or construction approvals received or applied for under the following programs 40 CFR 144.31(e)(6)		
Hazardous Waste Management program under RCRA.		Not required.
UIC Program. Class VI UIC Permit.		Application submitted.
NPDES program under the Clean Water Act (CWA) for CCS.		Will submit application prior to injection well construction.
PSD Program.		Not required.
CAA Nonattainment Program.		Not required.
NESHAPS Preconstruction Approval under the CAA.		Not required.
Ocean Dumping Permits under MPRSA.		Not required.
Section 404 Dredge and Fill Permits.		Not required.
Other Relevant Environmental Permits.		Not required.

Table 1-5: General Class VI CO_2 injection well permit application information.

As part of the Class VI permit application process, the project will complete separate impact assessments in accordance with the National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA). These assessments will be completed in a timely manner to facilitate EPA review and coordination with relevant regulatory agencies, ensuring that potential impacts to historic properties and endangered species are appropriately evaluated and documented.

1.2 Site Characterization

1.2.1 Regional Geology, Hydrogeology, and Local Structural Geology [40 CFR 146.82(a)(3)(vi)]

The Bonanza Sequestration project is geologically situated within the Hugoton Embayment of the Anadarko Basin—a broad, low-relief structural extension that spans much of western Kansas (Franseen, 2004). The Hugoton Embayment is bound to the east by the Central Kansas Uplift which runs northwest-southeast through the center of the state (**Figure 1-3**). This region has favorable geology for carbon storage in porous and permeable deep saline formations interstratified with low porosity and low permeability confining zones.

The present-day Hugoton Embayment and Anadarko Basin were part of a large epicontinental sea during a period of sea-level rise in the Late Cambrian (Derby, 2012). A broad shallow shelf covered much of the United States, depositing age equivalent carbonate rocks across multiple basins, in what is known as the Great American Carbonate Bank (**Figure 1-4**). Carbonate deposition continued in primarily carbonate shelf and ramp environments from the Cambrian through the Mississippian across the state of Kansas (Merriam, 1963).

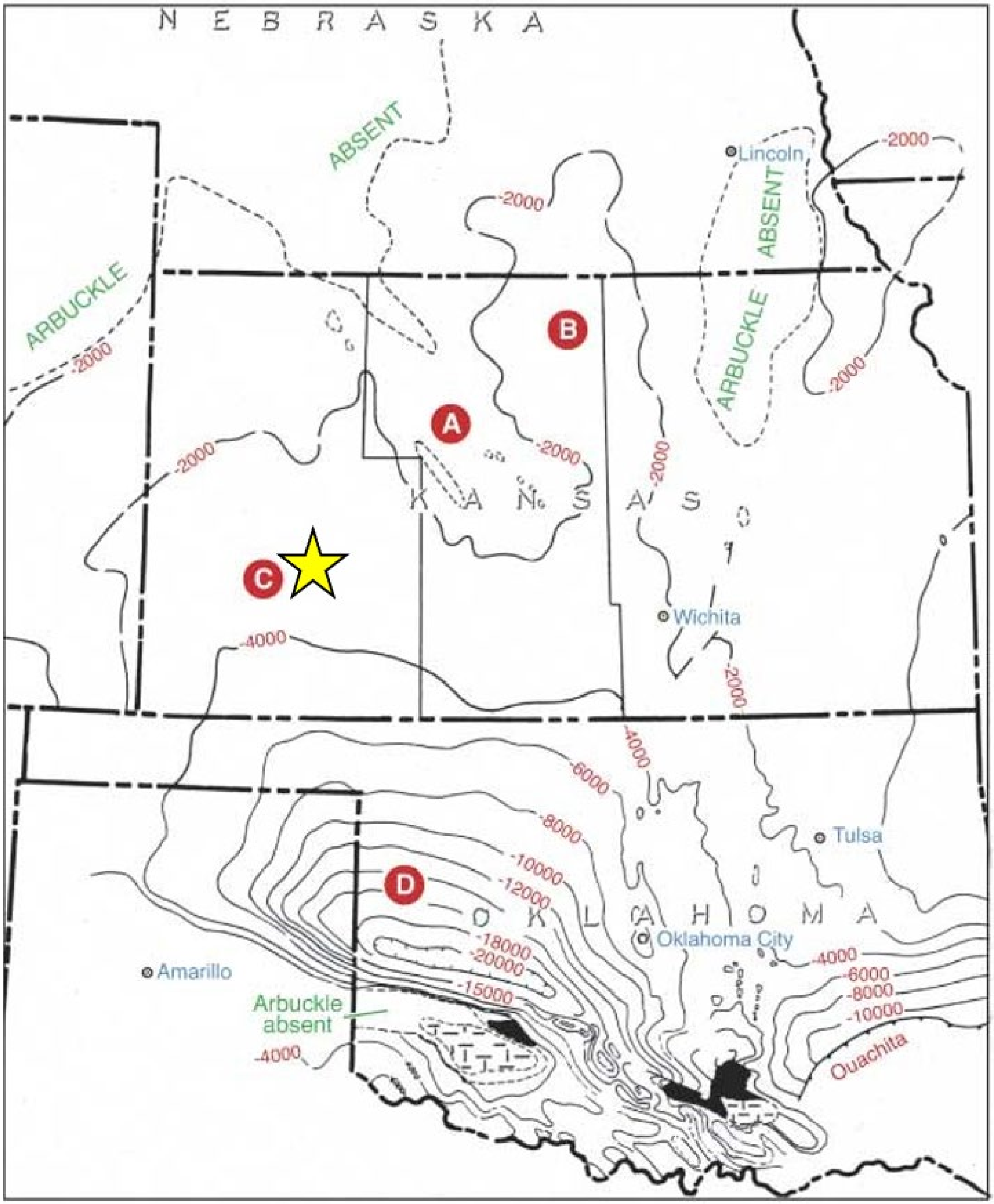

Figure 1-3: Present day structure on top of the Arbuckle formation. Letters denote structural provinces A) Central Kansas Uplift B) Salina Basin C) Hugoton Embayment D) Anadarko Basin. Bonanza Sequestration location denoted with yellow star (modified from Franseen, 2004).

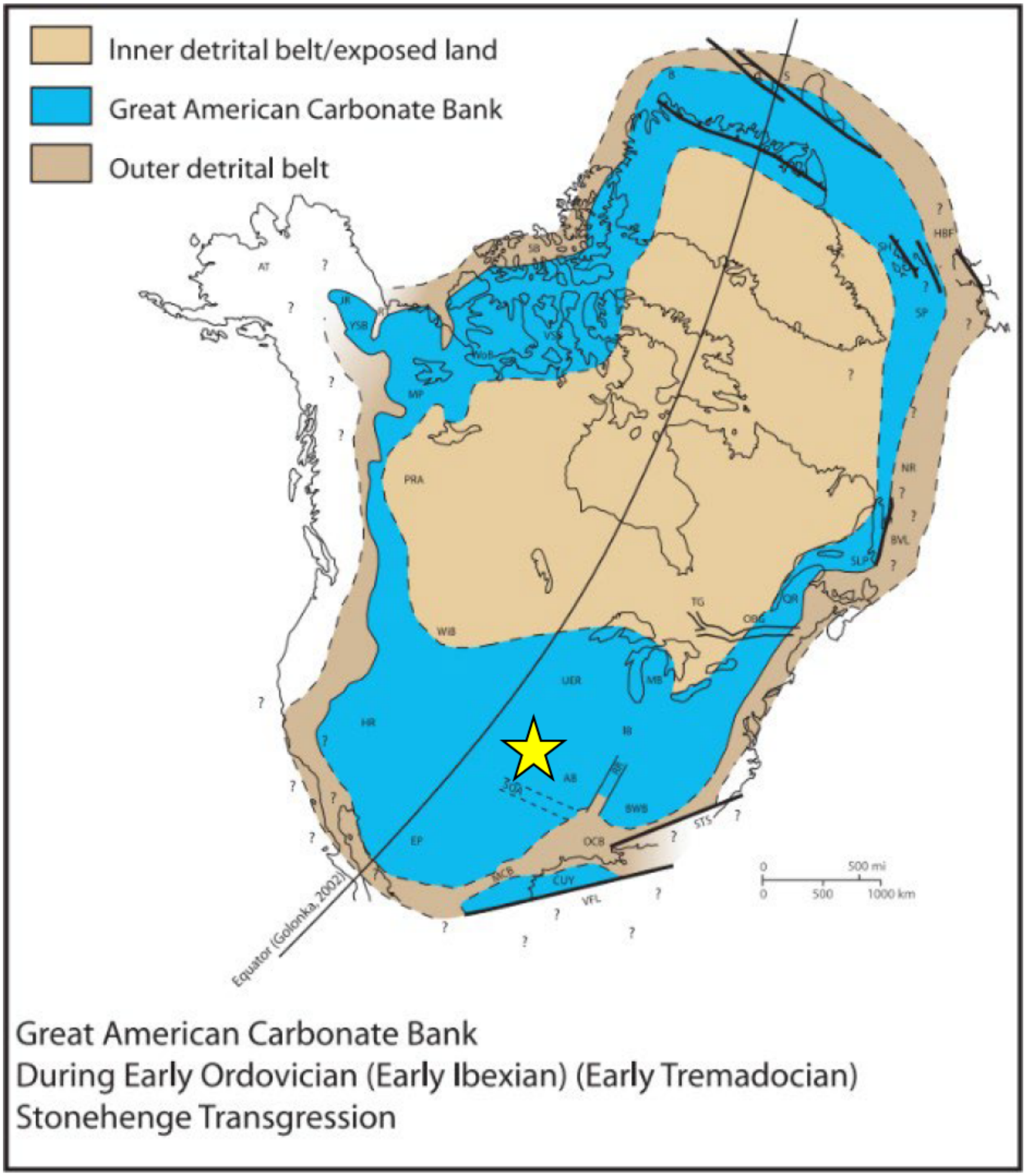

Figure 1-4 Extent of the Great American Carbonate Bank during Early Ordovician when the Arbuckle formation was being deposited. The Arbuckle and age equivalent shallow water carbonates are present across the Unites States. Approximate project site is denoted by the yellow star (modified from Derby et al, 2012).

Structural features in Western Kansas, such as faults and basement lineaments, generally trend northwest to southeast, aligned with the larger basement faults that make up the Central Kansas Uplift. Faulting within the Hugoton Embayment is normal faulting attributed to tensile stresses developed in a settling basin (Jewett, 1959). A single known fault or structural feature exists within Finney County, and faulting is generally rare in Western Kansas (Merriam, 1963). The closest identified fault to the project site is this unnamed fault in the southwest corner of Finney County, approximately 35 miles southwest of the Bonanza Sequestration site (**Figure 1-10**). The fault is described as a normal fault with offset that is considered subtle and difficult to determine in the subsurface based on well data (Merriam, 1963). It trends northwest to southeast, parallel to the basement faults of the Central Kansas Uplift.

Licensed and newly reprocessed 2D seismic data at the project site shows no faulting within the AoR, or near the site (Figure 1-11). Further information regarding detailed discussion of faults can be found in Section 1.2.3 - Faults and Fractures. The Precambrian basement in the Hugoton Embayment ranges in depth from 4,000 ft to 8,000 ft below the surface (Franseen, 2004). The primary synclinal axis of the Hugoton Embayment runs in a northwest-southeast direction, with a gently dipping axis to the southeast, where it connects to the Anadarko Basin at the Kansas-Oklahoma border and begins to deepen rapidly (**Figure 1-10**). The sedimentary rocks in this area are primarily Paleozoic in age, ranging from the Cambrian to the Cenozoic eras (Merriam, 1963).

The Arbuckle formation (storage formation) is composed of carbonate sediments, primarily dolomite with minor amounts of calcite, quartz and clay (Franseen, 2012). The depth to the top of the Arbuckle at the site location is approximately [redacted] ft MD (measured depth) from ground level, which corresponds to -[redacted] ft TVDSS. The Kinderhook formation, the primary confining zone, is primarily composed of carbonates, a mix of calcite and dolomite, with minor amounts of clay, anhydrite and quartz (Zeller, 1968). The depth to the top of the Kinderhook at the proposed site location is [redacted] ft MD, which equates to -[redacted] ft TVDSS. The stratigraphic column in **Figure 1-5** shows the study area's stratigraphic succession, highlighting the injection and confining zones.

[redacted]

Figure 1-5: Bonanza Sequestration stratigraphic column and gamma ray log plot from the Doll #1 STW. Depths are measured from ground level.

1.2.2 Maps and Cross Sections of the AoR [40 CFR 146.82(a)(2), 146.82(a)(3)(i)]

The formations found in the subsurface of the Bonanza Sequestration site are locally correlative and laterally extensive across the region, and none of the data reviewed suggest any formation pinch-outs within the area (**Figure 1-5**). This was evaluated and confirmed through regional reports, regional and local cross sections and maps, and well correlations throughout the immediate site location and surrounding area. Regional structure and thickness maps for these units and further detail on data types used can be found in Section 1.2.4. Major geologic units and their stratigraphic relationships are depicted in the local cross section shown in **Figure 1-7** and **Figure 1-8**.

Pickett plot analysis from the Doll #1 STW well logs indicates the deepest USDW (<10,000 ppm) total dissolved solids (TDS) is the [redacted]. The base of the [redacted] formation was picked at [redacted] ft MD based on drilling data and wells logs, where it unconformably overlies the Carlisle Shale formation, which begins the Upper Cretaceous series. Shallow stratigraphy is detailed in **Figure 1-7**. The base of the [redacted] ft above the top of the primary confining zone, the Kinderhook Formation. It is composed of loosely cemented sand, silt and gravel, with occasional caliche or carbonate beds (Zeller, 1968). Below the [redacted], the next shallowest porous beds are in the Dakota formation within the Lower Cretaceous group. Well log analysis from the Doll #1 STW indicates a salinity of [redacted] (**Figure 1-6**). Determining salinity via Pickett Plots is described in further detail in Section 1.2.8. At the Bonanza Sequestration site, the base of the lowest USDW is thus considered to be at [redacted] ft MD, which is equivalent to [redacted] ft TVDSS.

According to regional reports and publications, the lowest USDW at the project site is the [redacted] formation, which corresponds with Doll #1 well log analysis. The [redacted] serves as a significant water source for agriculture in Western Kansas and has been studied extensively for over 130 years (Nettleton 1892, Latta 1944, Zeller 1968 & 2008). At the project location, the Carlisle Shale formation lies directly beneath the [redacted] (**Figure 1-7**). This approximately 200 ft succession of chalky shales and bentonites separates the freshwater aquifer above from more saline water found in deeper formations (Latta 1944). The salinity increases rapidly with depth below the [redacted], due to the mineralogy of older rocks in Kansas, which contain gypsum, anhydrite and salt beds in the Cretaceous through Permian Systems (Zeller 1968, revised 2008).

[redacted]

Figure 1-6: Calculated log salinity estimates from the STW. The Arbuckle salinity is calculated to be [redacted] ppm, the Cretaceous [redacted] ppm, and the [redacted].

In terms of physiography, the Bonanza Sequestration project is situated within the Finney Basin of the High Plains region (**Figure 1-9**). This region is characterized by flat, gently rolling uplands, a few shallow valleys, and undrained depressions less than 20 feet deep. The Finney Basin is a broad, asymmetrical shallow depression that extends from the Arkansas River northward into Scott County (Meyer, 1970). Although the Arkansas River originates in the Rocky Mountains of central Colorado, irrigation practices in Colorado result in minimal water flow in Kansas for most of the year. The oldest rocks exposed at the surface in Finney County are the Upper Cretaceous Niobrara Chalk and Carlisle Shale within the Pawnee Drainage System (Meyer, 1970). Loess is the typical surficial deposit in the Finney Basin which is underlain by undifferentiated Pleistocene deposits.

[redacted]

Figure 1-7: Geologic cross section from North to South featuring the stratigraphic configuration of shallow subsurface strata, containing the USDW ([redacted]). Cross section is flattened on top of the Wellington Salt Formation. Logs courtesy of TGS.

[redacted]

Figure 1-8: Geologic cross section from North to South featuring the stratigraphic configuration of deeper subsurface strata, containing the storage formation and confining zone. Cross section is shown in MD and flattened on top of the Kinderhook Formation (confining zone). Note the two wells on the left did not penetrate the entire Arbuckle Formation. Logs courtesy of TGS.

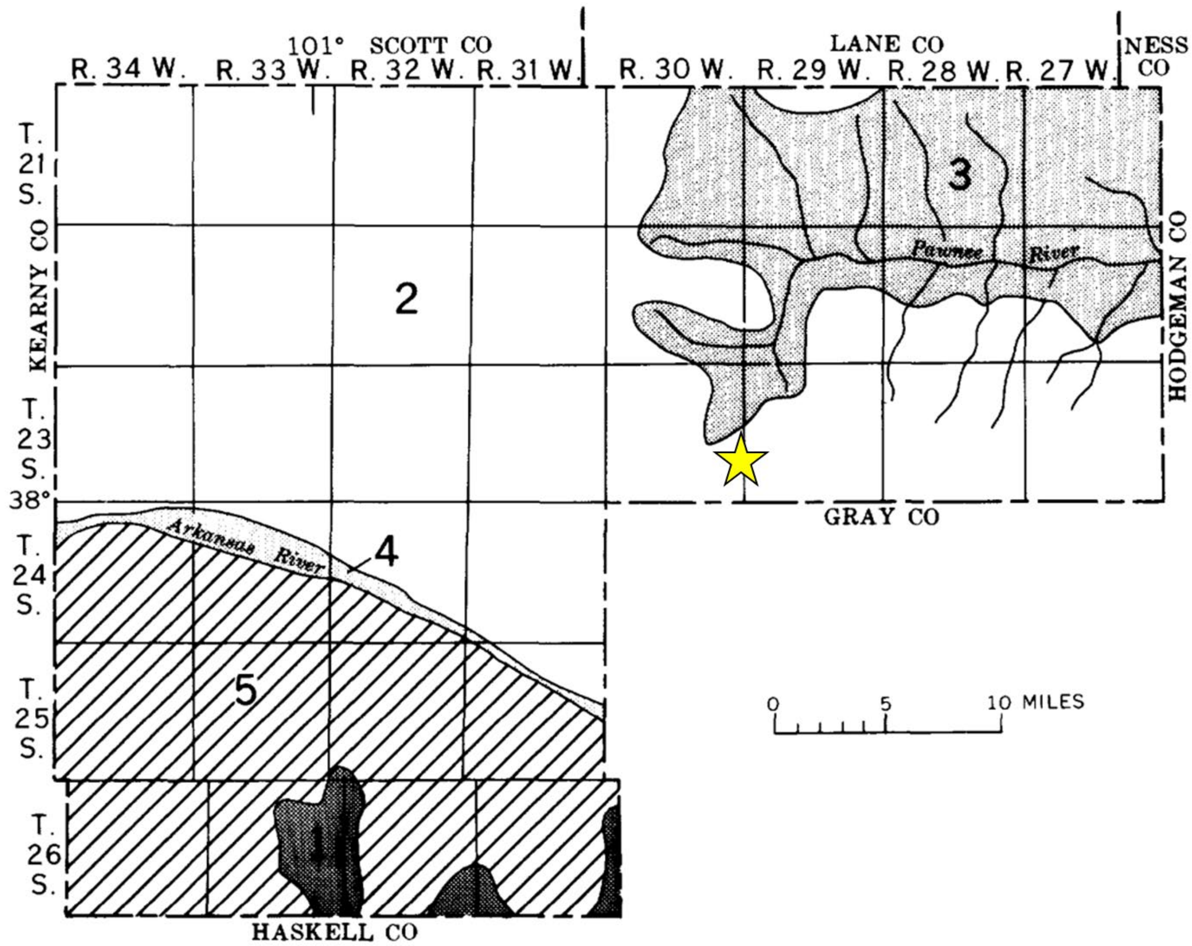

Figure 1-9: Physiographic regions of Finney County. Physiographic areas: 1) High Plains; 2) Finney basin; 3) Dissected High Plains/Pawnee drainage system; 4) Arkansas valley; 5) sandhills. Bonanza Sequestration site denoted by yellow star. Map modified from Meyer et al 1970.

A map of the AoR, including existing wells within the AoR and the proposed injection well is shown in **Figure 1-1**. The AoR for the Bonanza Sequestration site has a total of [redacted] known wellbores, including [redacted] water wells, [redacted] abandoned oil/gas wells, and the Doll #1 STW. Wells within the AoR were identified using databases held by the Kansas Geological Survey (2025a), TGS (2025), and Enverus (2025). The groundwater wells within the AoR vary in depth from [redacted] ft to [redacted] ft and are used for irrigation or domestic use. The oil & gas wells within the AoR are all dry holes that were exploring for oil in Mississippian carbonate reservoirs at depths of [redacted]' MD, which is ~[redacted]' above the top of the confining zone. Besides the Doll #1, which will be converted to the injector upon permit approval, no wells in the AoR penetrate the confining zone. Records of well status are available in the state of Kansas through the Kansas Geological Survey. More information on the wells within the AoR can be found in Permit Section 2.4.1 - AoR and Corrective Action Plan.

A thorough review of approved state and federal databases for surface and subsurface cleanup sites, including the Kansas Department of Health and Environment (KDHE), the KDHE Environmental Interest Finder (KEIF), and the EPA's Superfund National Priorities List and Superfund Alternative Approach databases, found 1 cleanup site located in the AoR (Figure 1-1). The site is a subsurface cleanup site found in the KEIF database in the LUST (Leaking Underground Storage Tanks) category. The site was active in 2000, when a buried diesel tank was removed, however inspection of the tank found no evidence of leakage and the site was assigned a closed status with no future cleanup required (S. O'Neal, personal communication, October 2025).

1.2.3 Faults and Fractures [40 CFR 146.82(a)(3)(ii)]

Regional tectonic structures within Kansas have been previously studied by many authors (Cole, 1962, Merriam, 1963, Newell, 1987, Baars, 1991 & Franseen 1994, 200, 2004, 2012), focused on both Precambrian structures and the current structural configuration. The nearest documented fault is an unnamed fault located approximately 35 miles southwest of the AoR (**Figure 1-10**) (Franseen, 2004). The fault is a normal fault with the downthrown side to the southwest. The maximum throw and offset of the fault are unknown, as authors consider it subtle and difficult to determine at depth based on available subsurface data (Merriam, 1963; Franseen, 2004). Several wells have been drilled on the upthrown side of the fault, where oil is produced from Mississippian aged carbonate reservoirs (Kansas Geological Survey, 2025a; Enverus 2025).

[redacted] in support of the subsurface study and assessment of any potential faulting at the Bonanza Sequestration site. The [redacted] line closest to the proposed injection location was also reprocessed to enhance subsurface imaging. A total of [redacted] lines were licensed (**Table 1-6**), with [redacted] lines oriented approximately [redacted]. The locations of these seismic lines can be seen in **Figure 1-11**. Sonic and density logs from the Doll #1 STW were used to create a seismic-to-well tie. Additionally, [redacted] was collected to improve shallow velocity control and constrain velocities for time-to-depth conversion of the interpreted time horizons. The seismic data was used to confirm that no faults could be readily identified in the confining and injection zones and were of sufficient quality to integrate into regional structural surfaces. **Figure 1-12** shows the Pre Stack Time Migration (PSTM) data from SEI's Line B-B'.

Image logs were acquired in the Doll #1 over the intervals of interest, including the Arbuckle formation (storage formation) and the Kinderhook formation (confining zone). [redacted]

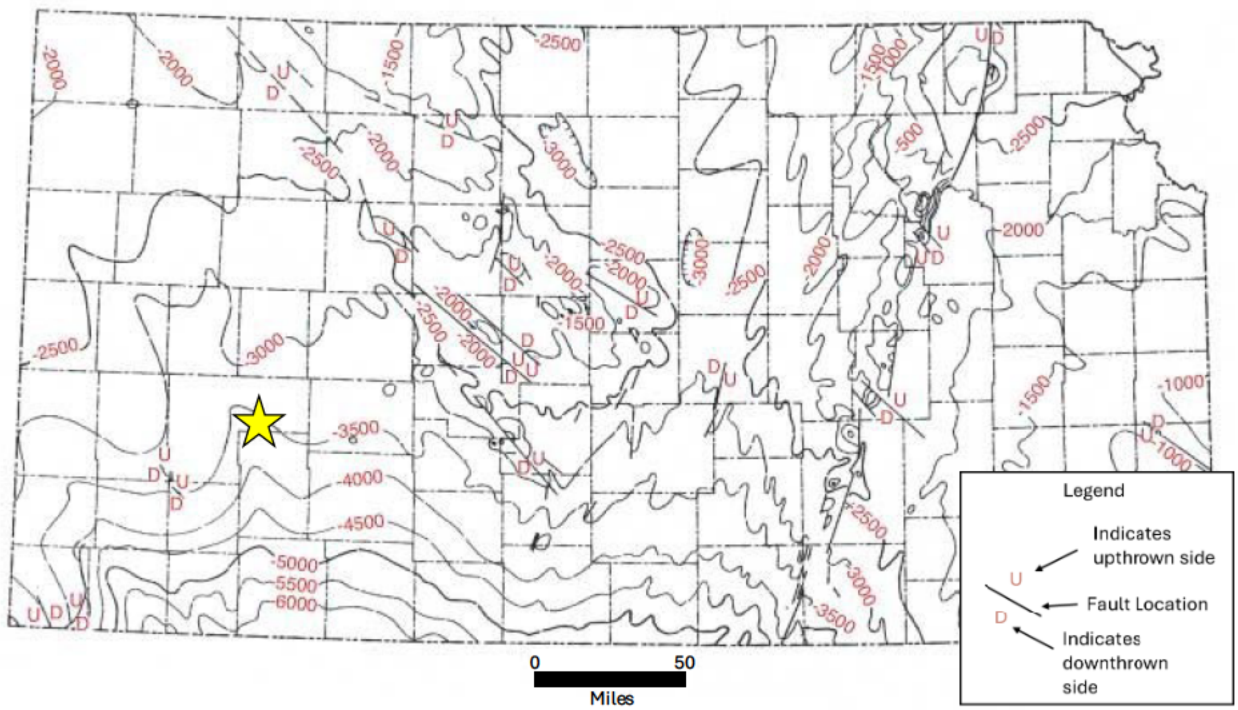

Figure 1-10: Depth to basement (TVDSS) and documented faults in Kansas; Bonanza Sequestration site denoted with yellow star (modified from Franseen, 2004).

[redacted]

Figure 1-11: Map of the 2D seismic data collected and used for subsurface interpretation at the Bonanza Sequestration site. The site location is labeled as Doll #1. The SEM/DRM boundary is shown with the 20 x 20 mi square. The yellow line highlights the extent of the seismic line shown in **Figure 1-12**.

[redacted]

Table 1-6: Summary of 2D seismic data licensed for Bonanza Sequestration project.

[redacted]

Figure 1-12: [redacted] with associated horizon interpretation. (Seismic Data owned or controlled by Seismic Exchange, Inc. and licensed by Conestoga Energy Holdings, LLC; interpretation is that of Battelle). Refer to **Figure 1-11** for seismic line location.

1.2.4 Storage Formation and Confining Zone Details [40 CFR 146.82(a)(3)(iii)]

In addition to the site-specific data acquired in the STW, additional subsurface data were analyzed from regional wells where modern wireline log data exists, as well as historical log data from wells in proximity to the site (**Figure 1-13**). Well logs from [redacted] existing wells surrounding the Bonanza Sequestration site were obtained, which provided multiple log types and the required spatial and depth coverage. These were used to develop structural surfaces throughout the area. Of these wells, eight had sufficient log data to provide local measurements of in-situ physical rock properties, such as porosity, at depths that captured the target storage formation and confining zone formations (**Table 1-7**).

The Doll #1 STW was drilled within the AoR in January of 2025 to confirm storage and confining zone presence and storage quality. This well collected modern wireline [redacted] that provided site-specific storage formation information such as the expected formation depths and thicknesses (**Table 1-8**), as well as porosity and permeability values. Further information regarding the data collected in this well is discussed in permit Section 1.2.5 and Section 5.2. These datasets enabled the interpretation of crucial subsurface information regarding the lithology and rock properties of the storage formation and confining zone.

[redacted]

Table 1-7: Regional wells used in addition to the Doll #1 STW for subsurface characterization. The Coordinate Reference System is UTM Zone 14N.

The 2D seismic lines described in Section 1.2.3 also contributed to understanding the storage and confining formations. The Doll #1 was used for a seismic-to-well tie to SEI's Line B-B' leveraging the [redacted] (time/depth) information. Seismic interpretation was completed for key horizons to confirm lateral extents of formations (**Figures 1-11**). The 2D seismic interpretations and associated time and depth grids were integrated with well tops and regional structure maps to create structure grids in the SEM.

[redacted]

Figure 1-13: Map of the petrophysical and structural control wells used for subsurface interpretation at the Bonanza Sequestration site. The Doll #1 STW and proposed injection well is denoted with a yellow star. The SEM boundary is denoted with the yellow line.

[redacted]

Table 1-8: Table of formation depths and thicknesses of confining and injection formations.

Confining Zone: Mississippian Kinderhook Formation

Regional well data and site-specific well data collected at the project site in the Doll #1 STW indicate the confining zone at the site location is the regional and laterally extensive Mississippian aged Kinderhook formation. The Kinderhook formation rests unconformably over the Viola formation and below the Osage member of the Mississippian Group. It is composed of fine-grained limestone and dolomite, with minor amounts of quartz sand, silt and clay (Goebel, 1968, Zeller, 1968). The Kinderhook formation was deposited in a shallow marine setting on a gently sloping carbonate ramp (Geobel, 1968 & whole core analysis). Carbonate sediments, the limestone and dolomite, were precipitated in the Inner and Middle Ramp in open marine, barrier/shoal, and lagoonal environments. Clastic sediments, sand, silt and shale, were deposited in the Inner ramp behind the barrier/shoals in lagoonal and mud flat settings (Kahn, 2021, **Figure 1-14**).

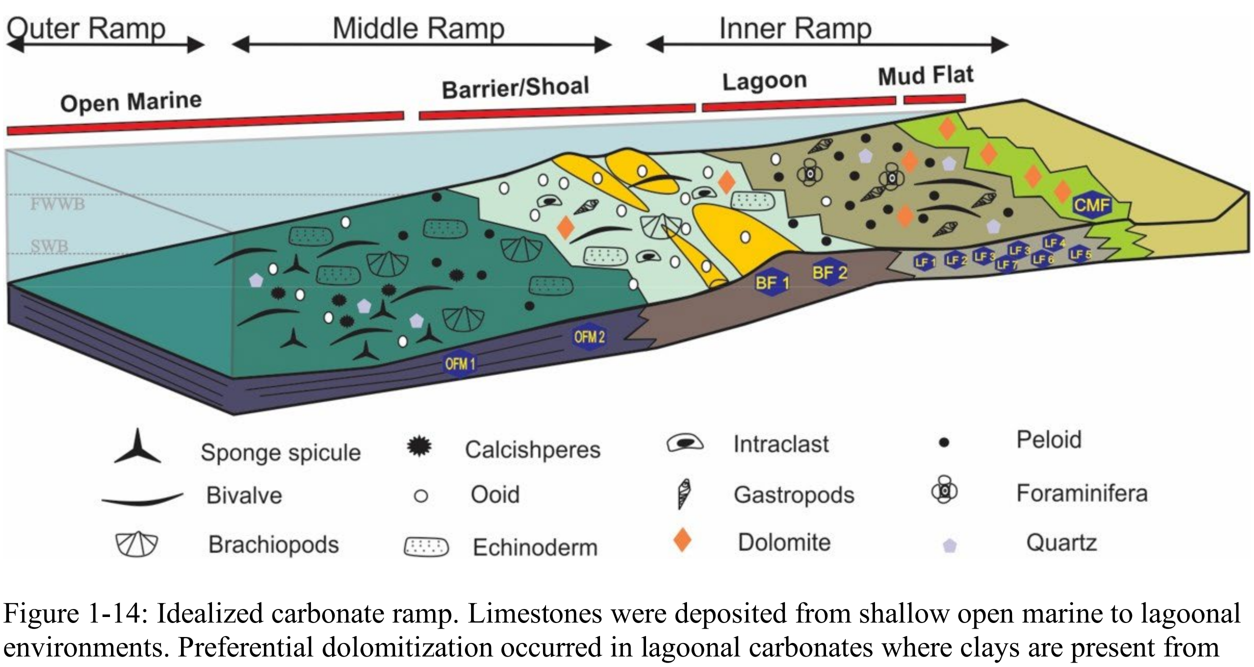

Figure 1-14: Idealized carbonate ramp. Limestones were deposited from shallow open marine to lagoonal environments. Preferential dolomitization occurred in lagoonal carbonates where clays are present from terrestrial input. Clastic sediments were deposited in the shallowest water depths in mud flat and lagoonal environments. (modified from Kahn, 2021)

The Doll #1 STW, drilled at the proposed injection site, the top of the Kinderhook formation was encountered at a depth of [redacted] ft MD, corresponding to [redacted] ft TVDSS, with a gross thickness of [redacted] ft. Depth and thickness across the AoR were determined by picking formation tops from digital and raster well log data proximal to the site and correlating those formation tops to 2D seismic data. The interpretations were then gridded using a minimum curvature interpolation algorithm in GeoGraphix. These structure grids were then exported into Schlumberger's Petrel® to create the structural framework of the SEM. Maps of the top structural surface and the thickness of the Kinderhook formation are presented in **Figure 1-15**.

[redacted]

Figure 1-15: Structural map showing True Vertical Depth Sub-Sea (ft) to the top of the Kinderhook Formation (left) and formation thickness map for the Kinderhook Formation (right) at the Bonanza Sequestration site. Contour intervals are 50 ft and 20 ft, respectively, for the structure and thickness maps. The extent of the contour grid indicates the Static Earth Model area.

Regional well log analysis indicates that the Kinderhook formation exhibits relatively low porosity and permeability. A total of [redacted] feet of whole core was collected from the Kinderhook interval in the Doll #1 STW. Core descriptions and laboratory analyses characterize the formation as heterogeneous, with low effective porosity throughout. Dolomite is the primary mineral at the top and base of the formation, with a thick section of fine to very fine-grained, fully cemented limestone grainstones to wackestones in the middle. Dolomite selectively replaced intervals that were originally deposited as micritic limestone with clay laminations. These dolomitic intervals are characterized by alternating laminations of clean dolomite and more clay-rich dolomite (**Figure 1-16**). Pore plugging anhydrite is present in the dolomite interval at the top of the formation. The limestones of the Kinderhook were deposited in middle ramp shoals to outer ramp open marine environments. The limestones are more massive bedded, with sequences up to 3 feet thick (**Figure 1-16**). They are well cemented and have measured permeabilities in the nano-darcies (**Table 1-10**).

Core analysis from plugs taken from both the limestone and dolomite facies have a porosity range from [redacted]% with permeabilities ranging from [redacted] (**Table 1-10**). This demonstrates that even at the occasional moderate porosities, permeabilities are low due to the fine-grained texture of the Kinderhook. The tight, impermeable nature of the Kinderhook formation, along with the lack of faults and natural fractures, indicates that it will serve as an effective confining zone.

Mercury Injection Capillary Pressure (MICP) measurements were taken on seven samples from whole and sidewall cores taken in the Kinderhook formation. Results of the MICP testing are shown in **Table 1-9**. The average pressure recorded in the Kinderhook formation, the confining zone, was 132 psi, with a peak value reaching 270 psi, significantly higher than samples in the storage formation. The threshold entry pressures observed during testing in the Kinderhook formation also resulted in a wider range of results due to finely laminated beds, and a variation of facies being tested. The overall heterogeneity, in both depositional and diagenetic make-up, along with the tight, impermeable nature and the lack of faults and natural fractures in this formation indicate that it will serve as an effective primary confining zone.

[redacted]

Table 1-9: Mercury Injection Capillary Pressure (MICP) measurements taken on whole core samples and rotary sidewall cores from the Doll #1 STW.

Storage Formation: Arbuckle Formation

The Arbuckle formation was deposited in Late Ordovician and Early Cambrian time. It rests conformably over the Reagan Sandstone and unconformably below the Simpson formation. During the time of deposition, Kansas was located ~20° south of the equator and the region was covered by an epicontinental sea (Franseen, 2004). A broad, shallow carbonate shelf covered Western Kansas, and a large part of the Unites States midcontinent, resulting in widespread carbonate deposition that is known as the Great American Carbonate Bank (Derby, 2012). The Arbuckle formation is present in the subsurface across most of Kansas, only absent in small areas on the Central Kansas Uplift and the Nemaha Uplift where PreCambrian basement is exposed at the surface (**Figure 1-10**, Merriam 1963). It was deposited initially in this highly saline sea as a limestone, then underwent dolomitization, the process by which the mineral dolomite replaces calcite, soon after. Multiple minor unconformities within the Arbuckle formation suggest frequent fluctuations in sea level (Fritz, 2012, Franseen, 1994, 2000). These sea level fluctuations, combined with complete dolomitization, have created significant secondary porosity and permeability throughout the Arbuckle (**Figure 1-20** and **Figure 1-21**).

The Arbuckle formation is a heterogeneous formation composed primarily of dolomite, with minor amounts of clay, feldspar and quartz, which is typically in the form of chert (Zeller, 1968, Franseen, 2012). [redacted]

While mineralogy is consistent throughout the formation, secondary processes, such as dissolution and dolomitization, create significant heterogeneity in pore types and pore structures (Franseen, 2012, Fritz, 2012). The process of dolomitization often removes the original rock fabric, however stromatolites and thrombolites were able to be observed in the whole core (**Figure 1-17**). These microbial structures make up large parts of the Arbuckle formation and are known to only be present in very shallow sea environments, confirming the depositional environments and regional interpretation. Further, it was noted in core descriptions that intervals with stromatolite and thrombolite structures typically had very high porosity and permeability.

[redacted]

Figure 1-16: Slabbed core photo from Doll #1, showing the Kinderhook formation at depths [redacted] to [redacted] Limestones (left) are massive bedded and very-fine grained, whereas dolomites (right) are characterized by abundant thin clay rich laminations and micritic in texture.

[redacted]

Figure 1-17: Slabbed core photo from Doll #1, showing the Arbuckle formation at depths [redacted] to [redacted]. Preserved microbial structures which confirm depositional environments are labeled.

[redacted]

Table 1-10: Summary of the mineralogical make-up of the Arbuckle formation measured by XRD in [redacted] core samples from the Doll #1 STW.

[redacted]

Figure 1-18: Ternary diagram displaying the compositional make up of rock samples collected in the Arbuckle Formation from the stratigraphic test well.

In the Doll #1 STW, the top of the Arbuckle formation was encountered at [redacted] ft MD, [redacted]. Maps of the top structural surface and the thickness of the Arbuckle formation are presented in **Figure 1-19**. Data from an MDT test within the Arbuckle formation indicates the pressure and temperature conditions are [redacted] which will sustain a [redacted] of the injected CO_2 at the site. Fluid samples taken during the drilling of the Doll #1 STW have a measured salinity of over [redacted] cutoff for saline storage (**Table 1-14**). Interpretation of 2D seismic lines and mapping from well logs show a modest variation in thickness across the SEM (<100 ft) and demonstrate no evidence of local formation pinch out or faulting that would affect CO_2 storage (**Figure 1-19**).

[redacted]

Figure 1-19: Structural map showing True Vertical Depth Sub-Sea (ft) from the surface to the top of the Arbuckle Formation (left) and formation thickness map (right) at the Bonanza Sequestration site. Contour intervals are 50 ft and 20 ft, respectively, for the structure and thickness maps. The extent of the contour grid indicates the Static Earth Model area.

[redacted]

Figure 1-20: Whole core plugs of the Arbuckle Formation from the Doll #1.

Analysis of regional well log data indicates that the Arbuckle formation exhibits relatively high porosity and permeability, although the porosity can vary significantly throughout the formation, ranging from [redacted] This porosity range is consistent with the values obtained from the Doll #1 STW [redacted]. To confirm regional data, [redacted] feet of whole core and five additional rotary sidewall cores were collected in the Arbuckle formation from the Doll #1 STW. Core data showed porosities ranging from [redacted] The highest porosity values were observed where dissolution created open, connected vugs, several examples of which was captured in the whole core and can be seen in **Figure 1-21**. Core permeability measurements in the Arbuckle range from [redacted]. These values are the Klinkenberg permeability measurements, which best reflect how supercritical CO_2 will behave in the rock at reservoir conditions. MICP measurements were taken on ten samples from whole and sidewall cores taken in the Arbuckle formation. The average capillary pressure recorded in the Arbuckle was 5.7 psi, with a peak value of 15.5 psi. A list of cores and their measured properties can be found in **Table 1-9** and **Table 1-10**. Both core and log data confirm the porous, permeable nature of the Arbuckle formation, which indicates that it will act as an excellent injection zone.

[redacted]

Figure 1-21: Slabbed core photo from the Doll #1 showing vuggy nature of the Arbuckle.

Current interpretations of the injection and confining zone at the site were confirmed by datasets acquired in the Doll #1 STW. Site-specific geologic [redacted] confirmed porosity and permeability, mineralogy, capillary pressure, and relative permeability as specified by EPA (2012) [40 CFR 146.82(a)(3)(iii)]. Routine core analysis was conducted on whole core plugs and rotary sidewall core samples by SLB. Additionally, geomechanical tests in the storage formation confirmed the maximum injection pressure, rock strength, and in-situ fluid pressure as specified by EPA (2012) [40 CFR 146.82(a)(3)(iv)] and are detailed in Section 1.2.5.

To assess the volumetric storage potential of the site, initial screening calculations were conducted. The Department of Energy (DOE)-National Energy Technology Laboratory (NETL) has proposed methods for static volumetric calculations (Peck et al., 2014). These methods, which operate at a field-averaged scale, are primarily useful as prospective and screening tools. More detailed site-specific characterization is provided in Section 2.0: AoR and Corrective Action.

Inputs for thickness and porosity were determined by calculating the average net thickness (net porosity cutoff of [redacted]) and effective porosity values from the Doll #1 STW log data for the Arbuckle formation ([redacted]). CO_2 volume was calculated within the reservoir simulation using the Peng-Robinson equation of state (Peng, 1976), using reservoir conditions measured in the STW. The input for the density of CO_2 was calculated at a depth of [redacted] MD, which is the midpoint depth for the Arbuckle formation in the center of the AoR where the Doll #1 STW was drilled. A storage efficiency factor of [redacted] was used based on lithology and depositional environment (Haeri, 2022). Applying those values yielded an estimated storage capacity for the Arbuckle formation within the AoR of approximately [redacted] MMmt of CO_2 per square mile. With an AoR of ~[redacted] square miles, that yields a storage capacity of [redacted] MMmt of CO_2, which is greater than the total proposed injection volume of [redacted] MMmt.

[redacted]

Table 1-9: Routine core analysis of whole core plugs and rotary side-wall cores of the Kinderhook and Arbuckle formations collected in the Doll #1.

1.2.5 Geomechanical and Petrophysical Information [40 CFR 146.82(a)(3)(iv)]

The mechanical strength of the confining zone, which serves as a metric for geomechanical integrity of the seal, was measured through laboratory testing of rock samples obtained from the Doll #1 STW in the Kinderhook formation. To assess rock compressive and tensile strength, uniaxial and triaxial testing, along with Brazilian tensile strength tests were conducted. These tests measure elastic parameters, peak compressive strength, and tensile strength. **Table 1-11** and **Table 1-12** present the elastic properties and peak strength (uniaxial and confined compressive strength) of rock samples under uniaxial and triaxial compressive tests. **Table 1-13** shows the tensile strength of the rock as measured by the Brazilian tensile test.

[redacted]

Table 1-11: Summary of rock mechanical properties for confining zone using uniaxial compressive test.

The data presented in **Table 1-11 and Table 1-12** indicate that the Kinderhook formation has an average confined (triaxial) compressive strength of [redacted] psi and an average uniaxial compressive strength of [redacted] These values are relatively [redacted] compared to average rock strengths, which are typically around [redacted]) or lower (ISRM Commission 1981, Sajid & Arif, M. 2015, Fjar et al., 2009). The high strength of the confining zone indicates that the rock can withstand significant compressive stresses and maintain its integrity and sealing capacity during CO_2 injection. The confining zone also has an average tensile strength of [redacted] psi (**Table 1-13**) with measured compressive and tensile strength within the expected range for consolidated rock samples (Fjaer et al., 2009; Rackley, 2017).

[redacted]

Table 1-12: Summary of rock mechanical properties for confining zone using triaxial compressive test.

[redacted]

Table 1-13: Summary of tensile strength of confining zone using Brazilian test.

Triaxial tests were also conducted to assess the ductility of the confining zone. **Figure 1-22** shows that the confining zone exhibits high residual strength after failure for confining pressure sample at [redacted] ft MD ([redacted] psi at confining pressure of [redacted] psi up to ~[redacted] psi at confining pressure of [redacted] psi), indicating a high degree of ductility. Mohr Coulomb plots in **Figure 1-23** show the internal friction angle [redacted] and [redacted] degrees) and cohesion strength ([redacted] psi and [redacted] psi) of the samples at depths of [redacted] ft MD and [redacted] ft MD during multi-plug triaxial test failure.

According to these rock mechanics test results, the Kinderhook Formation can provide sealing capacity as the primary confining unit due to its measured compressive strength and tensile strength. Analysis of residual stresses after rock failure in the triaxial compressive test indicates rock ductility as well.

[redacted]

Figure 1-22: Stress-strain plot for the Kinderhook samples at [redacted] ft MD with confining pressure of [redacted] Tests show residual strength after rock failure.

[redacted]

Figure 1-23: Mohr Coulomb Failure Envelope for Kinderhook samples at [redacted] ft MD (left) and [redacted] ft MD (right)

Petrophysical analysis was conducted to integrate available wireline log and core data in the study area to determine the properties of the storage system at the proposed injection well, and calibrate log inputs used to populate the SEM**.** The wireline logs collected from the STW include gamma ray, resistivity, neutron porosity, bulk density, dipole sonic, formation micro-imager (FMI) and nuclear magnetic resonance (NMR) (**Figure 1-24**). Analyses on core samples include routine properties such as porosity, permeability, and grain density. In addition to the STW data, regional well log data were compiled, as detailed in Section 1.2.4. Core data were integrated with porosity logs from the STW to refine porosity estimates. NMR-based permeability was validated with lab-measured permeability on the sidewall cores, identified by black points in **Figure 1-24**.

In situ pressures were measured using the MDT wireline tool via a packer assembly that isolates a portion of the formation face from the wellbore. Seven of these measurements were taken in the Arbuckle Formation. The regression of these pressure measurements with depth fell on a linear trend with an R^2 of [redacted] indicating strong linear correlation and high-quality data. The pressure gradient based on that linear regression of these data indicate the pressure at the top of the Arbuckle (-[redacted] ft TVDSS) is [redacted] psi. Additional discussion of in situ conditions is found in Section 2 – AoR and Corrective Action and a data can be found in Permit Section 5.0 – Pre-Operational Testing Plan, Appendix A.

[redacted]

Figure 1-24: Log plot of data acquired in the STW showing (left to right) stratigraphic zone, depth with caliper, gamma ray, resistivity, porosity, NMR permeability, NMR porosity, and lithology. Core-based porosity and permeability measurements are plotted in the NMR permeability and NMR porosity tracks in black points.

1.2.6 Seismic History [40 CFR 146.82(a)(3)(v)]

The seismic history for the area was characterized using publicly available data from the United States Geological Survey (USGS). Kansas has historically been considered a region of low to moderate natural seismic activity with occasional, small earthquakes. The state is located in the stable interior of the North American continent, not proximal to active plate boundaries. Naturally occurring seismicity in the state is associated with Precambrian basement faults causing earthquakes less than 4.0 in magnitude (Buchanan et al., 2015). This is consistent with the regional seismic hazard map published by the USGS (2024), which designates the area as a relatively low-risk area for seismic activity (**Figure 1-25**).

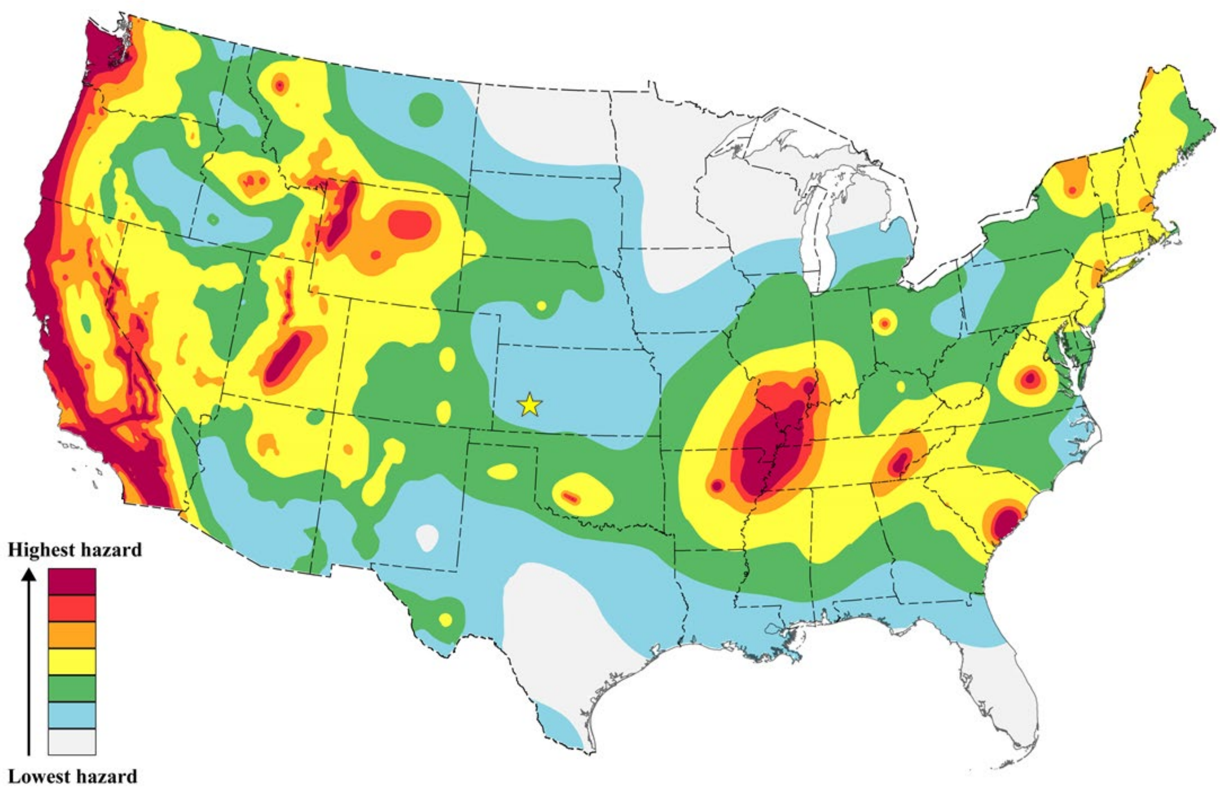

Figure 1-25: USGS regional seismic hazard map for the United States shows low hazard for natural seismicity in Kansas. Yellow star indicates the location of the Bonanza Sequestration Project site. Modified from USGS (2024).

In the early 2010s, Kansas experienced an increase in induced seismicity with increased hydraulic fracturing and deep wastewater disposal, particularly in Harper and Sumner counties in south-central Kansas (Buchanan et al., 2015). Finney County doesn't have a significant history of induced seismicity compared areas of concern over 150 miles east of the site. Additionally, overall induced seismicity has since significantly reduced in frequency and magnitude in the past decade. The Kansas Corporation Commission (KCC), the Kansas Geological Survey (KGS), and the Kansas Department of Health and Environment (KDHE) developed an earthquake monitoring and response plan in 2015 (KDHE et al., 2015) and implemented new regulations to limit the volume and pressure of wastewater injections in areas of dense seismic activity (KCC, 2015). The decline in seismicity in southern Kansas since 2015 is also noted by the USGS (Petersen et al., 2018). This study produced a one-year probabilistic seismic hazard forecast from induced and natural earthquakes that shows the chance of minor damage from an earthquake is less than 1% in Finney County and most of Kansas (**Figure 1-26**).

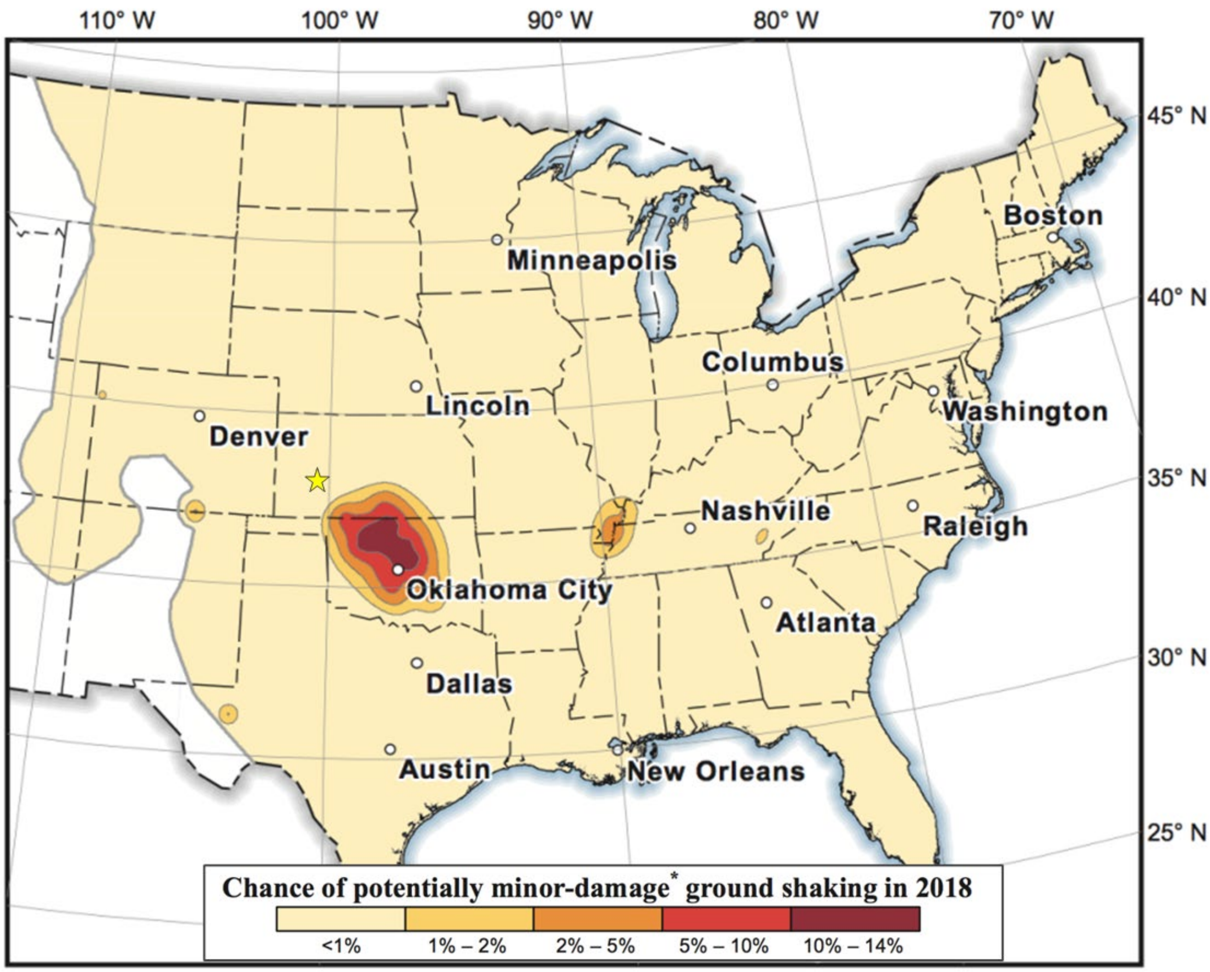

Figure 1-26: USGS one-year probabilistic seismic hazard forecast map showing chance of damage from an earthquake for the central and eastern United States from induced and natural earthquakes. The chance of damage at the site (yellow star) is less than 1%. Modified from Petersen et al. (2018).

Seismic events that occurred within 100 miles of the site from 1900 to June 2025 are mapped by magnitude in **Figure 1-27** and by year in **Figure 1-28**, and relevant details are tabulated in **Table A-1** in Appendix 1. All seismic events since 1900 have had a magnitude of equal to or less than 4.0. The closest seismic events to the site were 3.1 and 3.8 magnitude earthquakes that were recorded within minutes of each other in 1904 approximately 40 miles to the southeast, according to USGS records. The most recent seismic event was a 2.3 magnitude earthquake that occurred over 95 miles northeast of the site on June 4th, 2025.

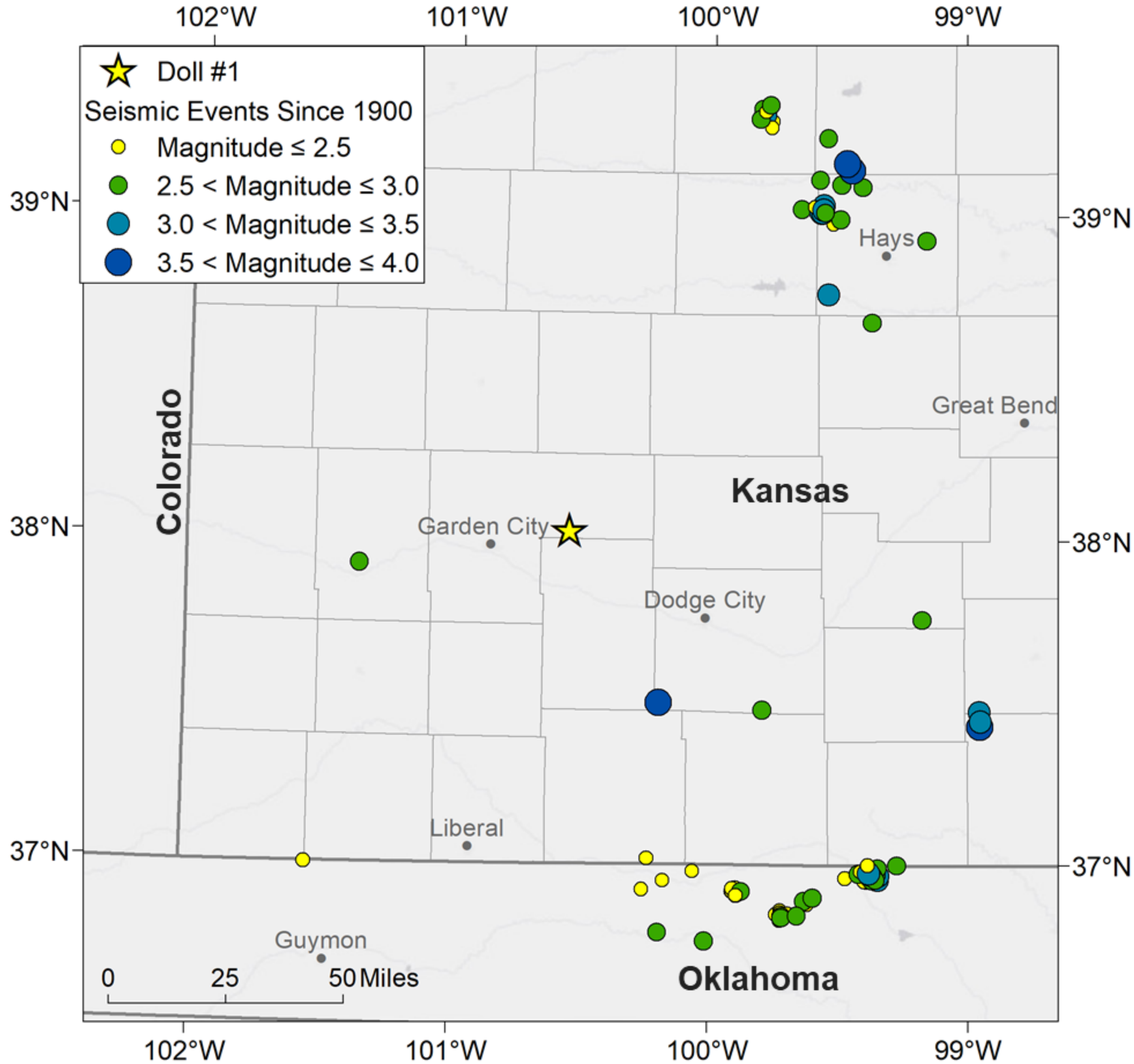

Figure 1-27: Map of seismic events from 1900 to June 2025 within 100 miles of the site (yellow star) by magnitude. Data is compiled from USGS (2025a). Yellow star indicates the location of the Bonanza Sequestration Project site.

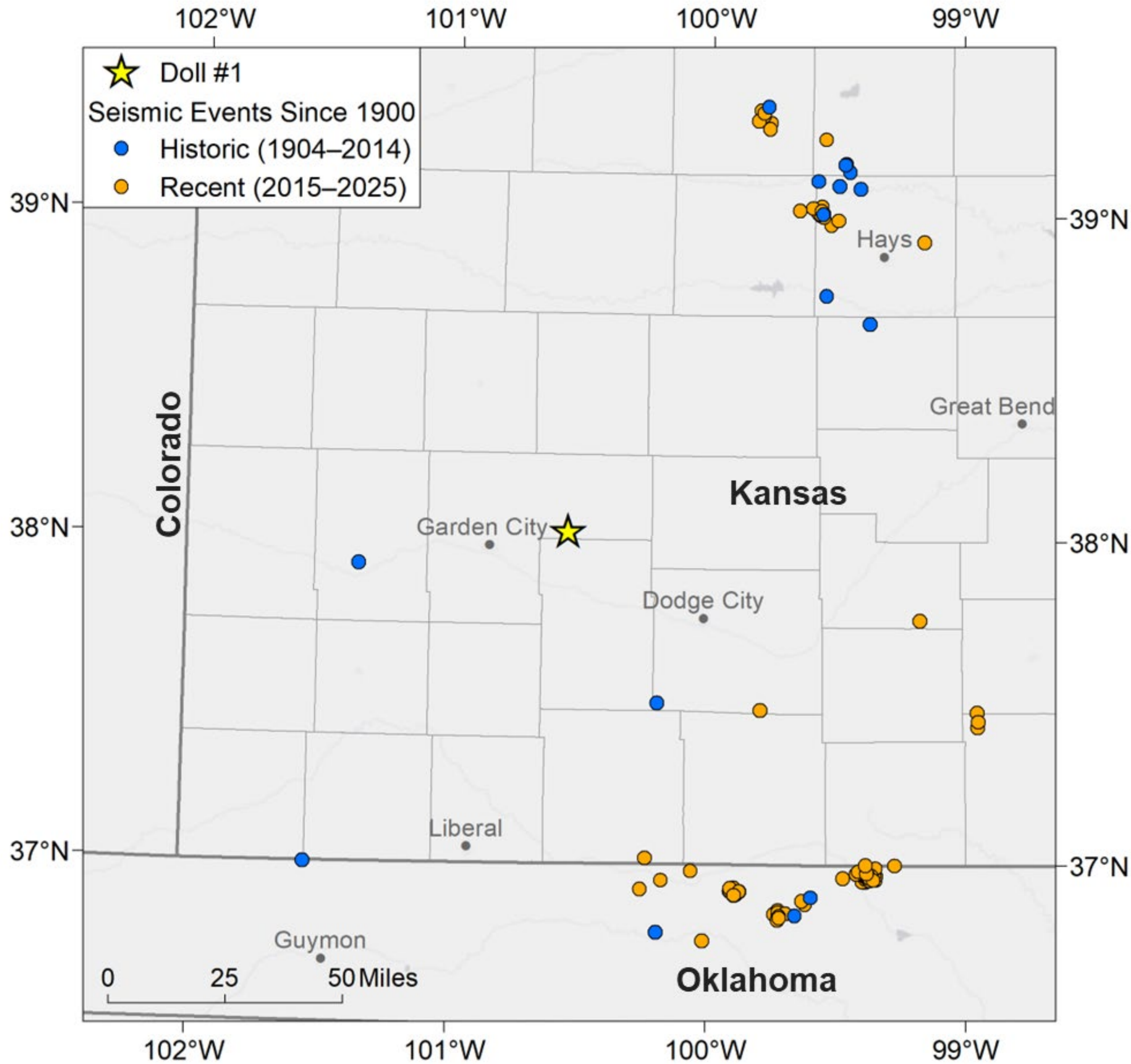

Figure 1-28: Map of seismic events from 1900 to June 2025 within 100 miles of the site (yellow star) by year. Data is compiled from USGS (2025a). Yellow star indicates the location of the Bonanza Sequestration Project site.

The rise of induced seismicity in southern Kansas was driven by the increased utilization of the Arbuckle Group as a disposal reservoir and its stratigraphic position overlying Precambrian basement faults. The injection of large volumes of wastewater causes pore pressure increases that reduce friction on pre-existing faults and triggering earthquakes (Ellsworth, 2013). Most faults reactivated during wastewater disposal were unmapped before they were indicated by induced seismicity (Rubinstein and Mahani, 2015). The licensing and interpretation of seismic data has been used to confirm the absence of any unmapped features that would increase the site-specific seismicity risk. Overall, the absence of unmapped basement faults coupled with regional data, suggests a low risk of seismic activity and associated risk to containment.

1.2.7 Hydrologic and Hydrogeologic Information [40 CFR 146.82(a)(3)(vi), 146.82(a)(5)]

Hydrologic and hydrogeologic information for the project site was compiled through resources made available by the Kansas Geological Survey, the Kansas Department of Agriculture Division of Water Resources, the Southwest Kansas Groundwater Management District 3, and the United States Geological Survey. Resources such as reports, map series, and shapefiles were utilized to determine surficial and bedrock aquifers present in the region and their approximate boundaries, aquifer depths and thicknesses, direction of groundwater flow, and locations of lakes, streams, and springs. No springs were identified within the AoR per the Kansas Geologic Survey databases (Buchanan, 1998).

Finney County is located within the High Plains drainage basin. Surficial aquifers are found along the Arkansas River and other river valleys but tend to be limited in extent and susceptible to drought and contamination. The shallow aquifers receive recharge from precipitation and discharge to local rivers and streams from the upper zones. The lower zones flow beneath local rivers and streams to discharge at larger regional discharge points. The primary stream in Finney County is the Arkansas River, which enters the county from the west and flows generally east-southeast through Garden City and into Gray County. Smaller tributaries and ephemeral streams in the county also tend to follow the regional topographic gradient. There are no natural lakes in the area larger than 10 acres, although smaller lakes and ponds are present. There are no active or inactive springs within the AoR (USGS, 2025b).

The primary USDW within the AoR is the Miocene-age [redacted] Aquifer, which is the most significant contributor to the greater High Plains Aquifer System. The High Plains Aquifer System spans across eight states in the Great Plains and is composed of several smaller, hydrologically connected aquifer units. The [redacted] Aquifer is the principal aquifer for the western half of the High Plains aquifer in Kansas. The High Plains Aquifer is generally unconfined and overlies a low permeability sequence of Cretaceous bedrock, such as the Graneros Shale and Greenhorn Limestone, that hydraulically isolates it from deeper units (Liu et al., 2010). Near the Bonanza project site, regional maps show the base of the [redacted] Aquifer is between [redacted] ft TVDSS (Macfarlane and Wilson, 2006). The Doll #1 confirmed the depth to the base of the [redacted] at [redacted]' TVDSS. Regional thickness, shown in **Figure 1-29**, ranges from a few feet to over [redacted] feet in southern Kansas but locally ranges from less than [redacted] ft to [redacted] ft in eastern Finney County (Kansas Geological Survey, 2025b). It's composed of unconsolidated sand, gravel, silt, and clay deposits sourced from the Rocky Mountains and local sources (Buchanan et al., 2015). A cross section of the [redacted] Aquifer and other shallow subsurface stratigraphy is shown in **Figure 1-7.**

The [redacted] supplies the majority of water for irrigation, municipal, and industrial use. Many high-capacity irrigation wells are present in the region with typical yields ranging from 500 to 1,000 gallons per minute. There are six water wells within the AoR used for domestic, feedlot, and oilfield water supply. They range in depth from 105 to 200 ft MD. Precipitation is the main source of recharge with minor amounts from percolating irrigation water. Recharge rates are much lower than withdraw rates, typically less than 1 inch per year. A potentiometric map is shown in **Figure 1-30**. Regionally, groundwater generally flows from higher water table elevations in the west to lower elevations in the east. Variations in local flow direction are influenced by pumping centers and variations in aquifer thickness. The potentiometric surface is approximately 2,700 ft TVDSS (Kansas Geological Survey, 2025b).

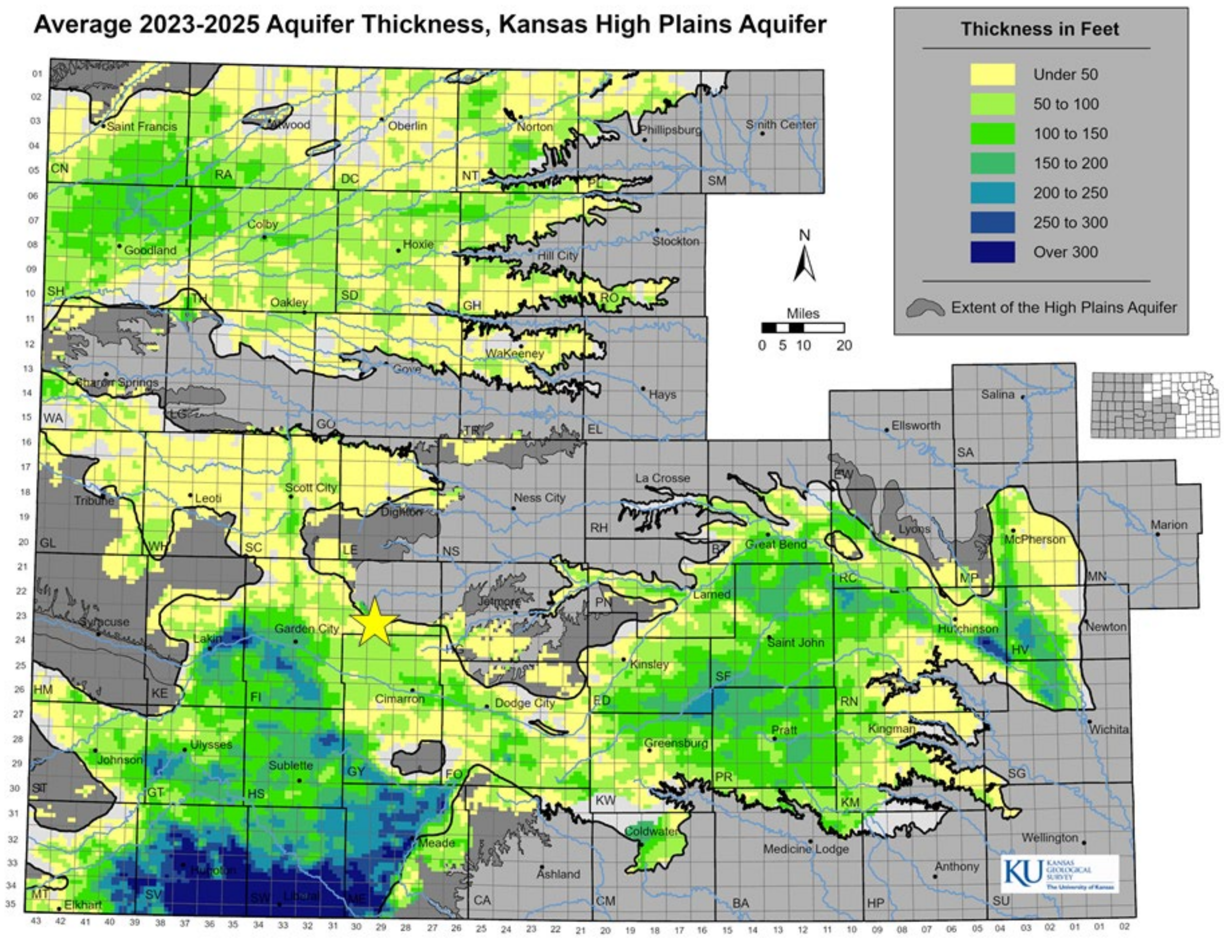

Figure 1-29: Aquifer thickness map of the High Plains Aquifer System in western Kansas. The Bonanza Sequestration site is indicated by the yellow star, where the aquifer thickness varies from less than 50 ft to up to 100 ft. Data is compiled from Kansas Geological Survey (2025b).

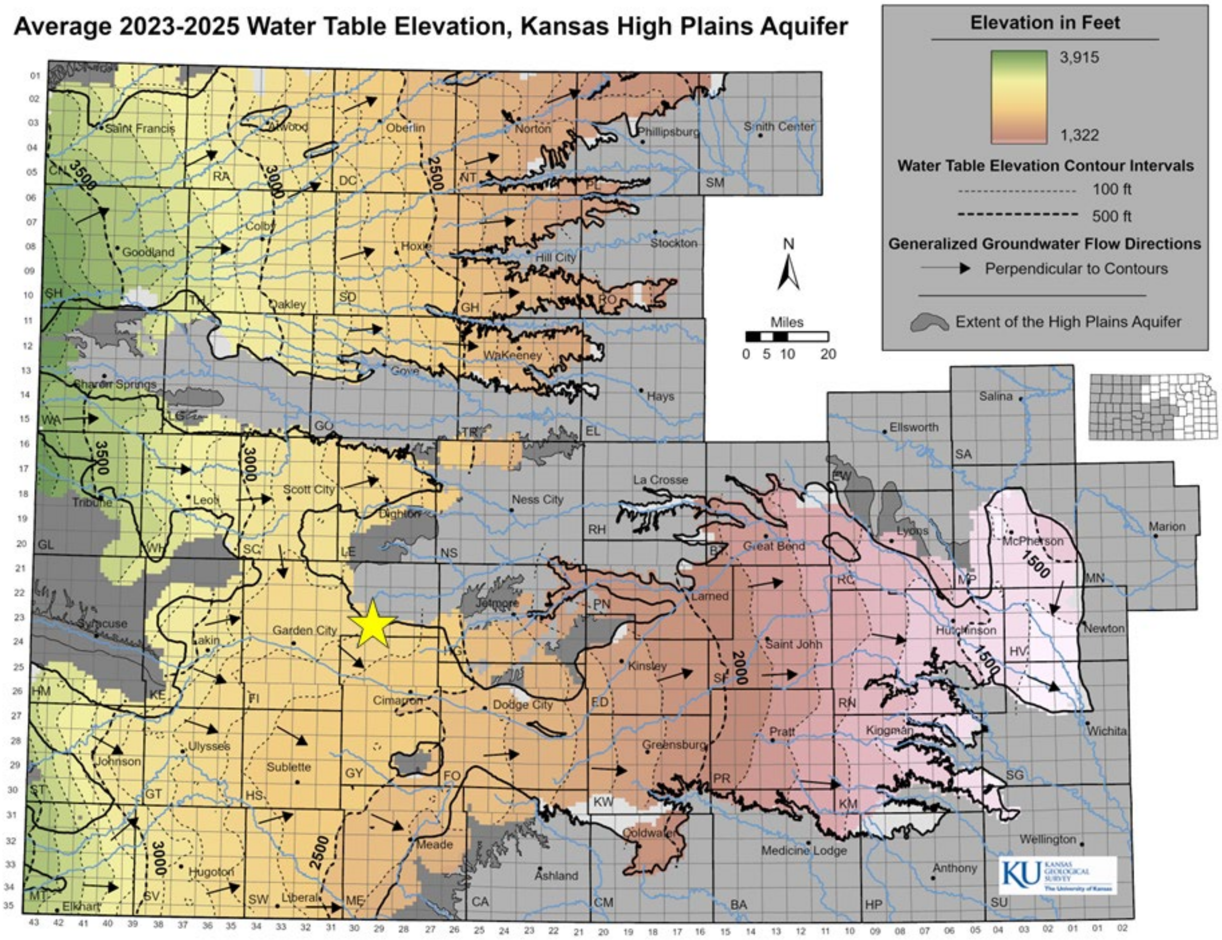

Figure 1-30: Water table elevation map (potentiometric surface) of the High Plains Aquifer System in western Kansas. The Bonanza Sequestration site is indicated by the yellow star, where the water level is approximately [redacted] ft TVDSS. Data is compiled from (Kansas Geological Survey, 2025b)

1.2.8 Geochemistry [40 CFR 146.82(a)(6)]

Site-specific fluid and log data were integrated to assess geochemistry of the storage system and compared to regional geochemical data (see section 1.2.2). Fluid samples from three depths in the Arbuckle, Viola, and Osage formations were collected from the Doll #1 STW in pressure vessels using the MDT wireline tool and analyzed at in situ pressures (Appendix A, 5.0 Pre-Operational Testing Plan). Geochemical results are shown in **Table 1-14**. Water samples were analyzed for aqueous-phase geochemical data including major cations and anions, trace metals, and general geochemical properties (i.e., pH, TDS, alkalinity, etc.). These analyses have been used to determine baseline geochemical data for the project site to evaluate any migration of CO_2 and brine waters at the site. See Section 1.2.4 for discussion on mineralogy and solid-phase geochemistry of the injection and confining zones.

In addition to fluid sampling and analysis, log analysis was used to assess the geochemistry of the storage system. Pickett plots, also known as the resistivity-porosity method, are a graphical solution to Archie's water saturation equation and are a cross-plot of deep resistivity versus porosity on a log-log scale (**Figure 1-31**). Formation water resistivity is a function of salinity and temperature, so in saline aquifers where the formation is fully saturated, Pickett plots can be used to determine formation salinity (U.S. EPA, 1988; Pickett, 1973). The red and blue lines represent lines of equal water saturation, with the red line drawn through the fully water-saturated reservoir log derived data. The red line is extrapolated to Total Porosity = 1 and the intercept indicates a resistivity of the water in the formation (Rw) at in-situ formation temperature. The Rw is converted to salinity in parts per million (ppm) using an industry standard chart within the petrophysical software (U.S. EPA, 1988). The slope of these lines is the m-exponent (cementation factor), and the n-exponent (saturation exponent) and a-factor (lithology coefficient) are standard inputs into the Archie equation. These Pickett-plot-derived salinity values should be considered an approximation of salinity. The Pickett plot using log data from the Doll #1 well show an average salinity of [redacted] ppm TDS in the Arbuckle (**Figure 1-31**), which is very close to the salinity measured in the Arbuckle fluid analysis which was [redacted] ppm. Therefore, the Arbuckle salinity is significantly greater than the regulatory lower limit of 10,000 ppm TDS.

[redacted]

Table 1-14: Site-specific geochemistry data analysis and results.

[redacted]

Figure 1-31: Calculated log salinity of the Arbuckle interval from the STW. The Arbuckle salinity is calculated to be [redacted] pp

In addition to the analysis described above, geochemical modeling was conducted to assess the compatibility of the CO_2 stream with formation fluids and minerals in the injection and confining zones (40 CFR 146.82(c)(3)). This modeling assessed the interaction between injected CO_2 and the storage formation (including the formation water), with a focus on mineral alterations, changes in the pH, and ion exchange processes associated with these reactions. Additionally, the study aimed to infer potential changes in porosity and permeability resulting from mineral dissolution and precipitation. Further details of this analysis can be found in Appendix A.

The analysis utilized the PHREEQC software, a widely used geochemical modeling tool that enables simulation of complex water-rock interactions and provides robust predictions of geochemical evolution under varying conditions. The model was parameterized using data from the Pitzer database, which is often used for CCUS systems with high ionic activities, enhancing the reliability of the simulations.

Field data collection included live water samples from the Arbuckle and Viola as well as the thin sections from the mineralogical composition data derived from X-ray diffraction (XRD) analyses for all relevant formations (Kinderhook, Simpson, Viola, Arbuckle Injection Zone (AIZ), the Arbuckle below the Injection Zone (ABZ), the Reagan Sandstone, and the Precambrian Basement). The study focused primarily on the AIZ, but also considered the confining zone and other formations, recognizing that CO_2 may eventually migrate upward and interact with this seal passing through the Viola and Simpson. The underlying Precambrian basement, which is rich in minerals aluminosilicate and clay minerals, not present in the Pitzer database, was not included in the PHREEQC simulations; instead, its potential geochemical behavior was addressed through a discussion of the potential buffering capacity of the formations between the AIZ and Precambrian Basement (i.e., the ABZ and Reagan Sandstone). Overall, this study aims to predict how CO_2 injection could alter the geochemistry of the reservoir over time and to evaluate the potential impacts if the CO_2 plume were to come into contact with both the confining zone and the underlying basement rock.

[redacted]

1.2.9 Other Information (Including Surface Air and/or Soil Gas Data, if Applicable)

No surface air and/or soil gas data have been or are planned to be collected at the site.

1.2.10 Site Suitability [40 CFR 146.83]

An extensive set of subsurface data has been analyzed at the Bonanza Sequestration site to support the evaluation of site suitability. The integration of site-specific well logs from the Doll #1 STW integrated with regional maps and cross sections confirm the lateral extent of the storage formation and confining zones. Licensed and interpreted 2D seismic data has confirmed the absence of faulting at the site location and surrounding area that would impact the integrity of the storage formation and confining zones. Therefore, the containment risk is low, and although multiple secondary confinements zones are present, none are necessary for USDW protection. Except for the Doll #1 STW, which will be converted to the injection well during the construction phase, there are no deep wellbore penetrations into the confining zone above the storage formation within the AoR (refer to Permit Section 2.4.2 - Wells Penetrating the Confining Zone).

The Bonanza Sequestration site is suitable for CO_2 sequestration due to the favorable subsurface geologic properties of the storage formation and confining zone. The Arbuckle storage formation is primarily composed of dolomite and is 757 ft thick, with a net thickness of 260 ft and an average log measured porosity of 11.2% (**Figure 1-24**). The mineralogy of the Arbuckle is predominantly dolomite, with varying amounts of quartz and clay (**Table 1-8**). The thickness and porosity of the Arbuckle formation make the site optimal for CO_2 sequestration with a large CO_2 storage capacity. Based on the DOE-NETL methods for static volumetric calculations, the estimated storage capacity for the Arbuckle formation within the AoR is approximately 2.4 MMmt of CO_2 per mi^2 (See Section 1.2.4 for additional calculation details). With a total AoR area of approximately 12.6 mi^2, the Arbuckle formation provides more than enough storage capacity to accommodate the target injection volumes.

The Cambrian-Ordovician aged Arbuckle was deposited in a shallow, marine environment on a broad carbonate shelf that covered vast portions of the United States (Derby, 2012). Post-depositional processes, including dolomitization and partial dissolution, have created additional secondary porosity and permeability, especially in the form of vugs and increased intracrystalline porosity (Franseen, 2004). The resulting geometries are influenced by the orientation of the shoreline during deposition as well as post-depositional structural orientation, which ultimately has some influence on the direction of plume migration for the injected CO_2. These orientations are based on regional literature and image logs from the Doll #1 STW. These geometries were integrated into the SEM to provide depositionally-informed anisotropy, which resulted in local northeast trending depositional systems. Additional details regarding the SEM construction are provided in Section 2.1.4.

1.3 Permit Section 2.0: AoR and Corrective Action

This Area of Review (AoR) and Corrective Action Plan describes the computational modeling performed by Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") to derive the AoR and the corrective actions to be taken in response to changes in the AoR, in compliance with 40 CFR 146.84.

Computational modeling at the Bonanza Sequestration project location has been completed to delineate the plume size and shape, area of pressure buildup, and AoR for injected carbon dioxide (CO_2). A Static Earth Model (SEM) named Conestoga_SEM was prepared using the Schlumberger Petrel® modeling software. The SEM is a three-dimensional (3D) geocellular model that represents petrophysical properties within the stratigraphic formations intended for CO_2 storage, as well as the overlying confining zone. This type of model offers the best options for quantifying, visualizing, and simulating dynamic behavior through the subsurface geology at the site. By integrating multiple data types, the model represents the spatial distribution of available pore space and flow potential (permeability), enabling a data-driven estimation of CO_2 storage capacity. The SEM serves as the framework (in terms of delineating zones, surfaces, porosity, and permeability) for dynamic simulation of CO_2 injection.

Computational dynamic reservoir modeling to simulate CO_2 injection into the saline aquifer was completed using the 3D multiphase flow simulator CMG-GEM (Computer Modelling Group, 2024). In addition to the geological framework and associated properties of the SEM, parameters such as relative permeability, initial reservoir conditions, phase behavior, and well completion were added to the dynamic model for simulation. CMG-GEM is an equation-of-state based compositional simulator that models the transport and phase behavior of brine and CO_2 during the injection and post-injection stages of a project.

Doll INJ-1 has a modeled average injection rate of 793,000 mtpy for a 30-year injection period. In the model, the well is completed over a 650 ft vertical section of the Arbuckle formation (from -2,789 to -3,440 ft TVDSS).

The deepest USDW that overlies the Arbuckle formation at the Doll INJ-1is identified as the [redacted] Aquifer, based on Pickett Plot analysis of log data to locate the deepest formation with salinity below 10,000 ppm. Pressure in the storage formation was obtained from measured data collected in the STW. Brine density from the storage formation and USDW was recorded from direct measurement on formation fluid samples also from the STW. Due to the absence of pressure data in the USDW, a freshwater pressure gradient was used to calculate the pressure in the USDW. These data were used to calculate the critical pressure increase threshold of [redacted] psi. As the CO_2 plume's maximum extent is larger than the region where storage formation pressure increase exceeds the calculated threshold pressure ([redacted] psi), the maximum Base Case CO_2 plume extent is used to delineate the AoR. **Figure 1-32** shows the CO_2 saturation in map view and in vertical cross section view at the end of the 12 year injection period and the AoR.

[redacted]

Figure 1-32: Base Case CO_2 plume after [redacted] years of injection (end of injection period). The AoR outline is shown in black.

1.4 Permit Section 3.0: Financial Responsibility

The Financial Responsibility Plan is submitted as Section 3.0 to meet the requirements of 40 CFR 146.82(a)(14) and 146.85.

1.5 Permit Section 4.0: Injection Well Construction

1.5.1 Construction Procedures

The injection well has been initially drilled as a Stratigraphic Test Well (STW) and a comprehensive suite of wireline logs, core, fluid samples and reservoir testing were acquired in February 2025. Refer to Permit Section 5.0 – Pre Operational Testing Plan for more details. During the construction phase of this project, the STW will be converted to the injection well by final installation of the production casing string and other downhole components.

The injection well will be vertical from surface to total depth (TD) and designed to prevent the movement of fluids into or between underground sources of drinking water (USDWs) or into any unauthorized zones, and to permit the use of appropriate testing devices and workover tools. The design also accommodates monitoring of the annulus space between the injection tubing and long string casing (40 CFR 146.86 (a)(1,2,3)). The proposed injection well diagram is shown in Permit Section 4.0 – Injection Well Construction Plan, **Figure 4-2**. Additional safety systems related to the injection wellhead are noted in Permit Section 6.7.2 - Well Operations Plan. Specifically, an automatic surface shut-off system is planned upstream of the wellhead.

No completion stimulation beyond an acid-wash to clean up near wellbore drilling mud and cement invasion is planned at this time. The maximum injection volumes and pressures for this project are detailed in Permit Section 1.0 - Project Narrative and Permit Section 6.0 - Well Operation Plan. No oil or gas zones were encountered at this location.

1.5.2 Casing and Cementing

The well was designed using carbon steel for the casing and tubulars that are not expected to be in contact with a mixture of the injectant and formation waters. That is, the conductor, surface and second surface casing sections are all carbon steel. The cementing of the surface strings have also been circulated back to the surface. The deep casing string will be constructed with corrosion-resistant chrome ([redacted]) from the reservoir through the confining zone and carbon steel from above the confining zone to surface. The lower section of the wellbore is expected to have intermittent exposure to CO_2-formation water mixed fluids, especially in the initial phases of injection and intermittently when well workovers are performed throughout the project. Since the expected water content of the injectant stream will be greater than 50 parts per million (ppm), the injection tubing string and flow-wetted injection tree components will be composed of corrosion-resistant materials or coatings.

All selected casing and tubing grades and weights will be adequate for handling anticipated stress loads and pressures throughout the life of the project. A summary of the maximum injection and annular pressure is found in Permit Section 6.0 – Well Operations Plan. The downhole tubulars were analyzed to ensure their ability to withstand the anticipated loads they may undergo. This analysis reviewed loads during installation, drilling, injection, workover, and subsequent abandonment. Additionally, effects due to cyclical loading, temperature, and exposure to wellbore fluids were also assessed.

Table 1-15 summarizes the casing program with ratings for the injection well. All casing strings will be cemented to the surface and any changes to the final well design will be discussed with the UIC Director or representative. The design is robust, meeting industry accepted minimum safety factors with significant margin. API minimum safety factors based on [redacted] for collapse, [redacted] for burst and [redacted] for axial loading.

The deepest USDW has been confirmed from analysis with wireline logs calibrated to fluid sampling in the STW. Surface casing is set through all active drinking water depths, and the intermediate and production casings will provide additional layers of protection to the USDW.

The cemented casing strings (three in total) for the proposed injection well will all be cemented back to surface. The surface and intermediate strings are cemented using Type I/II and Class G cement. The injection string will be installed using a CO_2 resistant cement system as the tail mix in the storage formation and confining zone with Type I/II cement back to surface. The long string will utilize cement stage tools to enable proper placement of cement across the confining zone and back to surface. The casing within the storage formation will be uncemented as major losses are an issue and cementing the flow features of the Arbuckle would be counter-productive to the purpose of the well. The first stage of cement is targeted to seal the Simpson and Viola, losses were observed while drilling the Viola. The second stage of cement is targeted to properly seal at the confining zone and bring cement back to surface. **Table 1-16** gives a summary of the cement types, sacks, weight and yield to be used for each casing string. Additives may change slightly based on laboratory testing. Volumes may be adjusted based on expected hole enlargement during drilling operations.

1.5.3 Completion Strategy

The completed interval of this injection well will encompass the Arbuckle between approximately [redacted] measured depth (MD). The completion interval is uncemented chrome casing.

[redacted]

Table 1-15: Casing dimensions and ratings details.

[redacted]

Table 1-16: Summary of cement types and corresponding casing strings.

1.6 Permit Section 5.0: Pre-Operational Logging and Testing

The pre-operational formation testing program describes how Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") will meet the testing requirements of 40 CFR 146.87 and well construction requirements of 40 CFR 146.86.

At the Bonanza Sequestration site, a stratigraphic test well (STW), the Doll #1, was drilled at the eventual injection well location to provide the site-specific subsurface data required by 40 CFR 146.87 and to support subsequent geostatistical model building and CO_2 injection simulation. The well was spudded on January 19th 2025 and reached a total depth of 6,587'MD on February 26th 2025. After all required data had been acquired, the well was shut-in, secured, and the rig was released on March 8th 2025. The Doll #1 was drilled and completed in such a way that it can be converted to the injection well. Construction details of the converted injection well can be found in Permit Section 4 - Injection Well Construction Plan.

Data collected in the Doll #1 STW includes extensive wireline logs, cores, fluid samples, and formation geomechanical tests which have been incorporated into the static earth and dynamic models (Permit Section 2 – AoR and Corrective Action Plan) from which the AoR is derived.

Upon conversion of the Doll #1 to an injection well, the production casing will be cemented and logs will be acquired to evaluate cement quality and provide baseline data for external well integrity. Cement quality will be evaluated through a CBL-VDL log. If further investigation becomes necessary, an advanced ultrasonic logging tool will be run.

Internal and external Mechanical Integrity Testing (MIT) will be completed after the STW has been converted to the injection well. Upon completion, prior to operation, the injection well will receive an injectivity test with pressure fall-off to verify the hydrogeologic characteristics of the injection zone.

1.7 Permit Section 6.0: Well Operations

The Well Operations Plan describes the steps Bonanza Carbon Capture, LLC will take to ensure that injection pressure does not exceed 90 percent of the fracture pressure of the storage formation to reduce that risk that injection does not initiate new fractures or propagate existing fractures in the storage area. No injection will occur between the outermost casing protecting underground sources of drinking water (USDWs) and the well bore in accordance with 40 CFR 146.88 (b). The injection well construction is detailed in the Injection Permit Section 4 – Injection Well Construction Plan which addresses 40 CFR 146.88 (c).

The Well Operations Plan describes the source of the carbon dioxide (CO_2) that will be delivered to the storage site, its chemical and physical properties, and flow rate at the piping outlet. In addition, this section provides the monitoring that will be performed on the injection well to confirm mechanical integrity (40 CFR 146.89).

1.8 Permit Section 7.0: Testing and Monitoring

The Testing and Monitoring Plan describes how Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") will monitor the Bonanza Sequestration site pursuant to 40 CFR 146.90.

The Testing and Monitoring Plan has been developed to reduce the risks associated with carbon dioxide (CO_2) injection into the deep geologic subsurface at this site. Goals of the monitoring strategy include:

- Protecting underground sources of drinking water (USDWs),
- Ensuring that the injection well is operating as planned,
- Providing data to validate and calibrate the geological and dynamic models used to predict the distribution of CO_2 within the injection zone,
- Supporting data for Area of Review (AoR) re-evaluations over the course of the project at a minimum of every 5 years,
- Meeting the regulatory requirements of 40 CFR 146.90.

The Testing and Monitoring Plan will be adaptive over time; the plan will be adjusted to respond:

- As project risks evolve over the course of the project
- If significant differences between the monitoring data and predicted dynamic modeling results are identified
- If key monitoring techniques indicate anomalous results related to well integrity or the loss of containment

A Deep Monitoring Well (DMW), Doll DMW-1, will be drilled into the storage formation and an Above Confining Zone Monitoring Well (ACZ) well, Doll ACZ-1, will be drilled into the first permeable layer above the confining zone. The ACZ well will be adjacent to the location of the injection well to monitor the aquifers above the upper confining zone. A stratigraphic test well (STW), Doll #1 test well (Permit # 15-055-22630) was drilled to acquire site-specific subsurface geologic characterization. The STW will be converted to the injection well for this project.

Regional and site-specific data and computational techniques were used to model the growth of the CO_2 plume during injection and the post-injection period, with details found in Permit Section 2.0 - AoR and Corrective Action Plan.

These data sets and computational models were utilized to develop this Testing and Monitoring Plan and will be used for future re-evaluations of the AoR during the pre-operational, injection, and post-injection phases of the project (40 CFR 146.84 (e)).

If specified events occur while implementing the testing and monitoring plan, as described below, that initiate an action, the response actions will follow those described in Permit Section 10.0 - Emergency and Remedial Response Plan (40 CFR 146.94 (a)).

The Testing and Monitoring Plan will utilize several direct and indirect monitoring technologies throughout the injection and PISC phases that can be categorized in three ways:

- Operational monitoring - continuous activities of the injection operations – pressures, temperatures, injection rates
- Assurance monitoring – activities to confirm CO_2 containment beneath the confining zone. These include injection well integrity, above zone monitoring and groundwater monitoring
- Verification monitoring – activities to confirm the projected development of both the pressure plume and CO_2 plume over time. These include direct in zone monitoring and indirect plume monitoring

The general schedule and spatial extent for the monitoring activities in the baseline and injection phases of the project are shown in **Table 1-16**.

Monitoring Activity	Baseline Data Frequency	Injection Phase Frequency	Location
Assurance Monitoring:			
USDW Groundwater Sampling & Geochemical Analysis	Biannually	Quarterly	AoR groundwater well network
Pressure Sensors	Continuous	Annually	ACZ well (First permeable formation above confining zone)
Operational Monitoring:			
CO_2 Stream Analysis	Once	Quarterly	CO_2 delivery pipeline
CO_2 Stream	Once	Annually	CO_2 delivery pipeline
Corrosion Coupon Analysis	NA	Quarterly	CO_2 delivery pipeline
Injection Pressure	NA	Continuous	Injection well (Wellhead and downhole)
Mass Injection Rate	NA	Continuous	Injection wellhead
Injection Volume (Calculated)	NA	Continuous	Injection wellhead
Annular Pressure	NA	Continuous	Injection wellhead
Annular Fluid Volume	NA	Continuous	Injection wellhead
Temperature Measurement - DTS (External Mechanical Integrity Test)	Continuous (upon operable well)	Continuous	Injection, DMW, and ACZ Wells
PFO Tests	Once	Every 5 years	Injection well

Monitoring Activity	Baseline Data Frequency	Injection Phase Frequency	Location
Verification Monitoring:			
Fluid Sampling and Analysis	Twice	Annually	ACZ well
		Annually	DMW
Pressure & Temperature Sensors	Continuous	Continuous	ACZ well
			DMW
DTS (External Mechanical Integrity Test)	Once	Continuous	Injection, DMW, and ACZ Wells
Seismicity Monitoring	Prior to injection	Continuous	Seismic stations
Time-lapse 2D Seismic Surveys	Once	Every 5 years and as required	Surface/DMW

Table 1-17: General schedule and spatial extent for the testing and monitoring activities for Bonanza Carbon Capture.

1.9 Permit Section 8.0: Injection Well Plugging

The injection well plugging plan described in this section, details the methods and materials that will be used to plug and abandon the Doll INJ-1 injection well in accordance with 40 CFR 146.92. The well construction details for this injection well are provided in Permit Section 4.0 -Injection Well Construction Plan of this application, and includes the casing and cement used in the completion of the well. These details will be used to determine an appropriate approach to plugging the well to prevent migration of fluids upwards through the abandoned well. Permit Section 9.0 - Post-Injection Site Care and Closure (PISC) describes tests that will be performed prior to well abandonment to confirm the well has maintained mechanical integrity throughout the injection phase of the project.

Pursuant to the requirements of 40 CFR 146.92, specific data will be collected prior to plugging the injection well. The bottom-hole pressure will be determined and the mechanical integrity of the well casing will be confirmed prior to plugging and abandoning the well.

After the project has verified that there are no external well integrity issues, the well will be flushed with a buffer fluid to remove any fluids or particulates that may be present in the well (Section 8.6). The weight of the buffer fluid will be determined from the final reservoir pressure measurement and will be chemically compatible with the formation fluids and solids to reduce the potential of corrosion of the well materials. A minimum of three casing volumes will be displaced without exceeding the fracture pressure of the storage formation.

The injection well casing will be plugged with cement to ensure that it does not provide a conduit outside the storage formation. **Table 1-18** presents the intervals that will be plugged as well as the materials and methods that will be used to plug the intervals.

[redacted]

Table 1-18: Intervals to be plugged and materials/methods used. (40 CFR 146.92 (b)(3 – 6)).

1.10 Permit Section 9.0: Post-Injection Site Care (PISC) and Site Closure

This Post-Injection Site Care and Site Closure (PISC) plan describes the activities that Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") will perform to meet the requirements of 40 CFR 146.93.

At the end of the injection period, Bonanza Carbon Capture will either submit an amended PISC plan or demonstrate to the Director through monitoring data and modeling results that no amendment to the plan is needed.

Bonanza Carbon Capture will monitor groundwater quality and track the position of the carbon dioxide (CO_2) plume and pressure front for ten years after the end of injection which is the modeled time for CO_2 plume stabilization and for the pressure front to decrease to a value at which it no longer poses an endangerment to Underground Sources of Drinking Water (USDW) and the criteria described in Section 9.6 are satisfied.

An alternative PISC timeframe of [redacted] years (compared to the default of [redacted] years) is appropriate based on the results of the detailed geologic analyses and numerical plume and pressure-front modeling. Specifically, the pressure decline and stabilization of the CO_2 pressure plume following the end of injection. This rapid decrease in pressure within the storage formation at the end of the injection period as demonstrated above provides justification for an alternative PISC timeframe of 10 years (**Figure 1-33**).

[redacted]

Figure 1-33: Pressure time-series data over [redacted] years injection period followed by a [redacted] years post-injection at the gridblock of the topmost completion in the injection interval.

1.11 Permit Section 10.0: Emergency and Remedial Response

Bonanza Carbon Capture, LLC ("Bonanza Carbon Capture") will operate the Bonanza Sequestration project, inclusive of the pressure lines and injection well. Bonanza Bioenergy is the operator of the ethanol plant, which supplies the CO_2 for the project.

This Emergency and Remedial Response Plan (ERRP) describes response actions that Bonanza Carbon Capture will take to address events that have the potential to cause movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods of injection well Doll INJ-1, in accordance with 40 CFR 146.94. This plan additionally describes the local resources and infrastructure within the Area of Review (AoR).

This plan complements the existing Bonanza BioEnergy Emergency Planning and Response Policy (SOP 212-003).

An emergency shutdown of the injection well will be triggered if Bonanza Carbon Capture obtains evidence that the injected carbon dioxide (CO_2) stream and/or associated pressure front may cause endangerment to a USDW. In an emergency shutdown situation Bonanza Carbon Capture will perform the following actions:

1. Immediately cease injection and initiate shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the permitting agency/EPA Region 7 UIC Program Director of the emergency event within 24 hours.
4. Implement applicable portions of the ERRP.

If a serious or major emergency shutdown should occur, CO_2 injection will only resume with the consent of the UIC Program Director. If Bonanza Carbon Capture can demonstrate that the injection operation will not endanger USDWs, the UIC Program Director may allow the resumption of injection prior to remediation.

If a minor emergency shutdown of the CO_2 injection system is required, the operator will complete the shutdown in a stepwise approach to prevent over-pressure situations and/or damage to the equipment.

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Appendix 1: Tabulation of Seismic Events

Latitude	Longitude	Date	Magnitude	Depth (km)
39.2945	-99.7714	2025-06-04	2.3	5
39.315	-99.8027	2025-06-01	3.5	7.312
39.3322	-99.8107	2025-05-31	2.9	6.567
39.243	-99.5528	2025-01-24	2.6	5
39.2761	-99.7763	2024-12-06	2.4	5
39.3007	-99.8227	2024-12-02	2.6	9.404
39.3244	-99.7997	2024-08-29	2.5	4.806
37.7577	-99.1805	2023-08-19	2.6	5
36.9805	-100.0635	2022-06-11	1.85	7.27
36.85016667	-99.74083333	2022-05-25	1.77	5.46
36.94916667	-99.39016667	2022-01-24	1.54	6.19
36.97633333	-99.4185	2021-11-30	1.87	4.44
36.9665	-99.3945	2021-10-17	1.74	5.94
36.952	-100.1773333	2021-07-16	1.78	17.53
39.0168	-99.565	2021-06-29	2.9	6.29
36.88133333	-99.62116667	2021-06-04	1.52	5
36.84283333	-99.72433333	2020-12-12	2	5.16
36.8615	-99.72366667	2020-12-10	1.05	7
36.85516667	-99.72516667	2020-12-09	1.64	7.13
39.0149	-99.561	2020-10-16	2.5	5
36.96566667	-99.39883333	2020-10-15	1.59	7.18
36.95066667	-99.39933333	2020-05-18	1.46	5.89
36.97416667	-99.38766667	2020-02-02	2.16	6.87
36.92016667	-99.91283333	2020-02-01	1.71	7.75
36.90966667	-99.89733333	2020-01-31	2.34	7.43
36.91983333	-99.91	2020-01-31	1.89	7.77

36.90833333	-99.886	2020-01-22	2.24	7.68
36.905	-99.89516667	2020-01-21	2.49	6.81
36.91233333	-99.89516667	2020-01-21	2.47	7.49
36.92983333	-99.89783333	2020-01-21	2.34	9.15
36.9294	-99.9102	2020-01-21	2.4	5
36.9192	-99.872	2020-01-21	2.3	5
36.91983333	-99.87416667	2020-01-21	2.75	6.96
36.90716667	-99.89516667	2020-01-21	2.44	7.29
36.96066667	-99.4755	2020-01-12	2	5.17
36.92466667	-100.2578333	2019-12-12	2.45	6
36.96	-99.388	2019-12-08	1.97	6.29
36.96083333	-99.37716667	2019-08-12	2.9	5
38.9266	-99.1635	2019-08-11	3	5
37.02	-100.2411	2019-05-03	2.2	5
37.4786	-99.799	2018-10-30	2.8	5
36.8517	-99.6972	2018-03-19	2.1	5.319
36.8304	-99.7269	2018-03-18	2.3	5.742
36.9705	-99.3665	2018-03-16	2.7	4.411
36.9554	-99.3476	2018-02-16	3.1	2.882
36.9638	-99.3605	2018-02-04	2.7	4.649
36.9634	-99.3585	2018-02-01	2.7	4.47
36.9695	-99.3925	2018-01-24	2.5	7.884
36.9674	-99.3682	2018-01-21	2.9	5.834
36.9635	-99.3674	2017-12-19	2.5	2.516
36.9628	-99.3796	2017-12-14	2.9	3.458
36.9596	-99.37	2017-11-15	2.5	2.031
36.9534	-99.3706	2017-11-15	2.6	0.79
36.9748	-99.4244	2017-10-25	2.9	8.115
36.9648	-99.3747	2017-10-14	2.5	2.576

36.843	-99.7192	2017-10-13	3	4.033
36.9635	-99.3597	2017-09-28	2.5	1.54
36.9662	-99.3752	2017-08-29	2.6	1.314
36.9702	-99.3879	2017-08-26	2.4	2.825
36.9613	-99.3606	2017-08-24	2.3	1.266
36.9692	-99.3456	2017-08-15	3.1	5
36.9789	-99.3658	2017-08-15	3.1	5
36.9715	-99.38	2017-07-31	2.5	5.261
36.9719	-99.3531	2017-07-29	2.7	4.06
36.9821	-99.4148	2017-07-29	2.4	5
36.9917	-99.349	2017-07-28	2.7	5
36.9686	-99.3641	2017-07-26	2.6	2.7
36.9672	-99.3801	2017-07-25	2.7	3.347
36.9745	-99.3821	2017-07-24	2.9	3.306
36.9633	-99.3727	2017-07-23	2.5	2.703
36.955	-99.3576	2017-07-21	2.7	5
36.9766	-99.3847	2017-07-21	3.1	7.328
37.0022	-99.3887	2017-07-21	2.5	5
36.8901	-99.6323	2017-06-25	2.8	2.88
38.9802	-99.5324	2016-10-31	2.5	5
39.0107	-99.5775	2016-09-19	3.2	2.7
39.0237	-99.6559	2016-09-18	2.6	5
39.0022	-99.5624	2016-09-16	2.5	2.1
39.0154	-99.5827	2016-09-16	3.1	9.04
39.0129	-99.5747	2016-09-16	3.3	5
39.0361	-99.5676	2016-09-14	3.3	5
38.9924	-99.5042	2016-09-04	2.6	5
39.0315	-99.6054	2016-09-01	2.5	5.5
39.0227	-99.5705	2016-08-31	3.1	5.17

36.8383	-99.7198	2016-07-09	2.7	2.231
36.7662	-100.0157	2016-03-25	2.6	5
37.473	-98.9575	2015-09-18	3.4	5.39
37.0008	-99.2764	2015-07-09	2.6	5
37.4294	-98.9535	2015-05-23	4	5
37.4447	-98.9522	2015-05-23	3.3	5
39.092	-99.417	2000-02-04	2.8	5
36.846	-99.659	1999-10-25	3	26.1
38.674	-99.378	1999-01-07	3	5
36.9	-99.6	1995-03-23	2.8	5
38.76	-99.549	1992-07-15	3.3	5
39.1	-99.5	1992-04-02	2.7	5
39.168	-99.472	1989-07-13	3.4	5
39.013	-99.564	1989-07-06	2.7	5
39.143	-99.457	1989-06-16	3.8	5
39.165	-99.477	1989-06-08	4	5
39.115	-99.584	1989-01-27	2.6	5
36.993	-101.561	1986-11-05	2.4	5
37.918	-101.372	1986-10-20	3	5
39.344	-99.781	1986-06-02	3	5
36.791	-100.196	1983-03-11	2.7	5
37.5	-100.2	1904-10-28	3.1	0
37.5	-100.2	1904-10-28	3.8	0

Table A-1: Seismic events since January 1900 within 100 miles of the Bonanza Sequestration Project site. Data is compiled from USGS (2025a).