UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
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STATEMENT OF BASIS

CLASS I INJECTION WELL AREA PERMIT
CITY OF STERLING, CO
STERLING DEEP DISPOSAL WELL PROJECT
LOGAN COUNTY, CO

EPA AREA PERMIT NO. CO12163-00000

CONTACT: Chuck Tinsley
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This STATEMENT OF BASIS gives the derivation of site-specific UIC Permit conditions and reasons for them. Referenced sections and conditions correspond to sections and conditions in the Permit.

UIC Permits specify the conditions and requirements for construction, operation, monitoring and reporting, and plugging of injection wells to prevent the movement of fluids into underground sources of drinking water (USDW). Under 40 CFR 144 Subpart D, certain conditions apply to all UIC Permits and may be incorporated either expressly or by reference. General Permit conditions for which content is mandatory and not subject to site-specific differences (40 CFR Parts 144, 146 and 147) are not discussed in this document.

Upon the Effective Date, the Permit authorizes the construction and operation of a new injection well project governed by the conditions specified in the Permit. The Permit is issued for a period of ten years unless terminated for reasonable cause under 40 CFR 144.39, 144.40 and 144.41.

PART I. General Information and Description of Facility

City of Sterling, CO 421 N 4th St, PO Box 4000 Sterling, CO 80751-0400

on

January 15, 2010

submitted an application for an Underground Injection Control (UIC) Program Class I Area Permit for the following injection well Project:

Sterling Deep Disposal Well Project Location: S22, S23, S27, and the N½ of S34, T8N, R52W, Logan County, CO

Regulations specific to Class I injection well operations in the State of Colorado are found at 40 CFR 147 Subpart G.

The Permit application, including the required information and data necessary to issue a UIC Permit in accordance with 40 CFR Parts 124, 144, 146 and 147, was reviewed by EPA and determined to be complete.

These disposal wells are classified as Class I non-hazardous municipal disposal wells.

This Permit is issued for a time period of the (10) years and will expire after that time, or upon delegation of primary enforcement responsibility (primacy) for applicable portions of the UIC Program to the appropriate agency and that agency has the authority and chooses to adopt and enforce this Permit. If the permittee wishes to continue any activity regulated by this permit after the expiration date of this permit, the permittee must submit a complete application for a new permit at least 180 days before the permit expires.

Area Permit Boundary

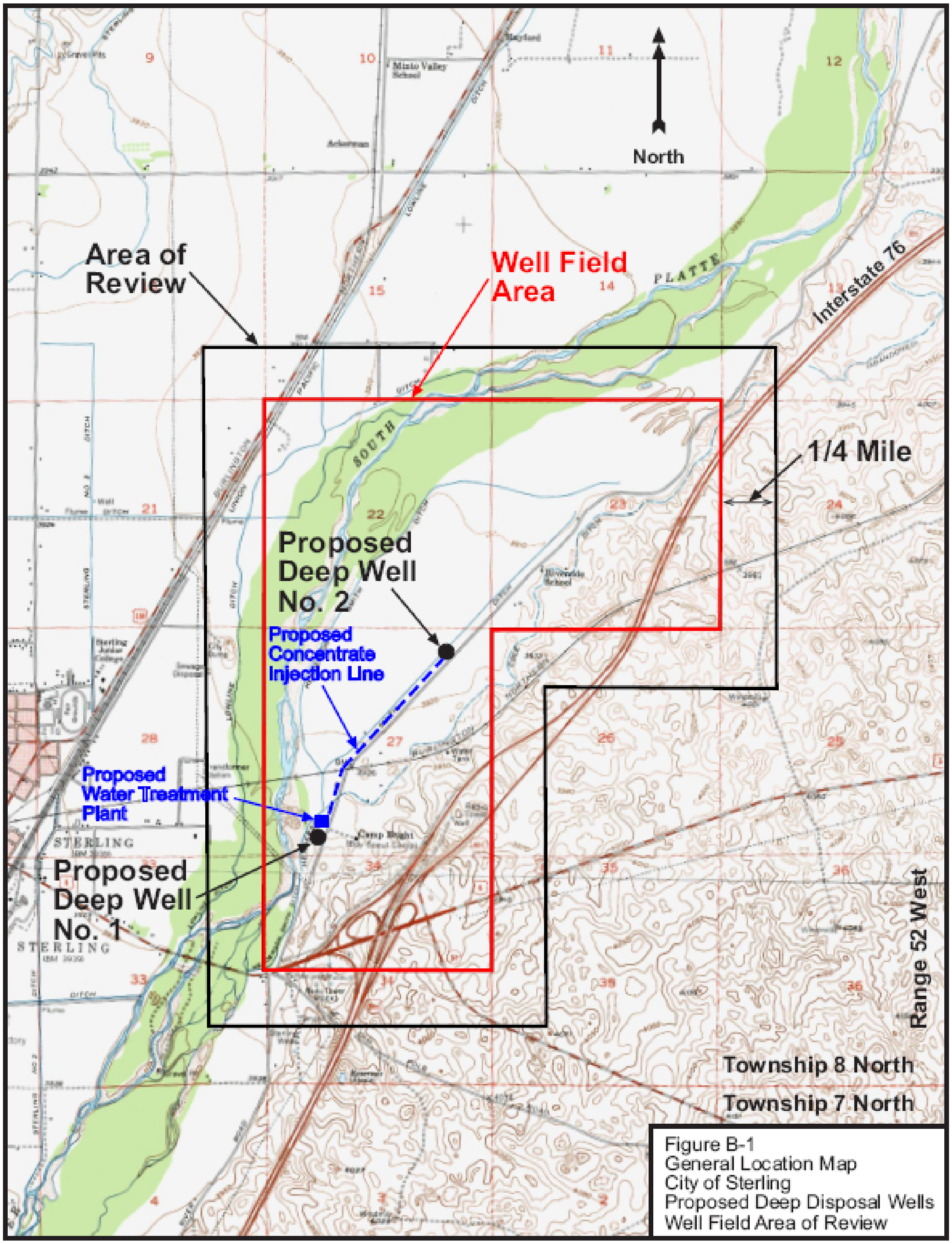
This project is issued as an area permit and is described by the boundary enclosing the entirety of Sections 22, 23, 27, and the north ½ of Section 34, in Township 8 North, Range 52 West, Logan County, Colorado. As part of the review for this permit, an area extending 1/4 mile outside of this project area (Area of Review, or AOR) is studied for potential impacts from injection activities.

Well Locations

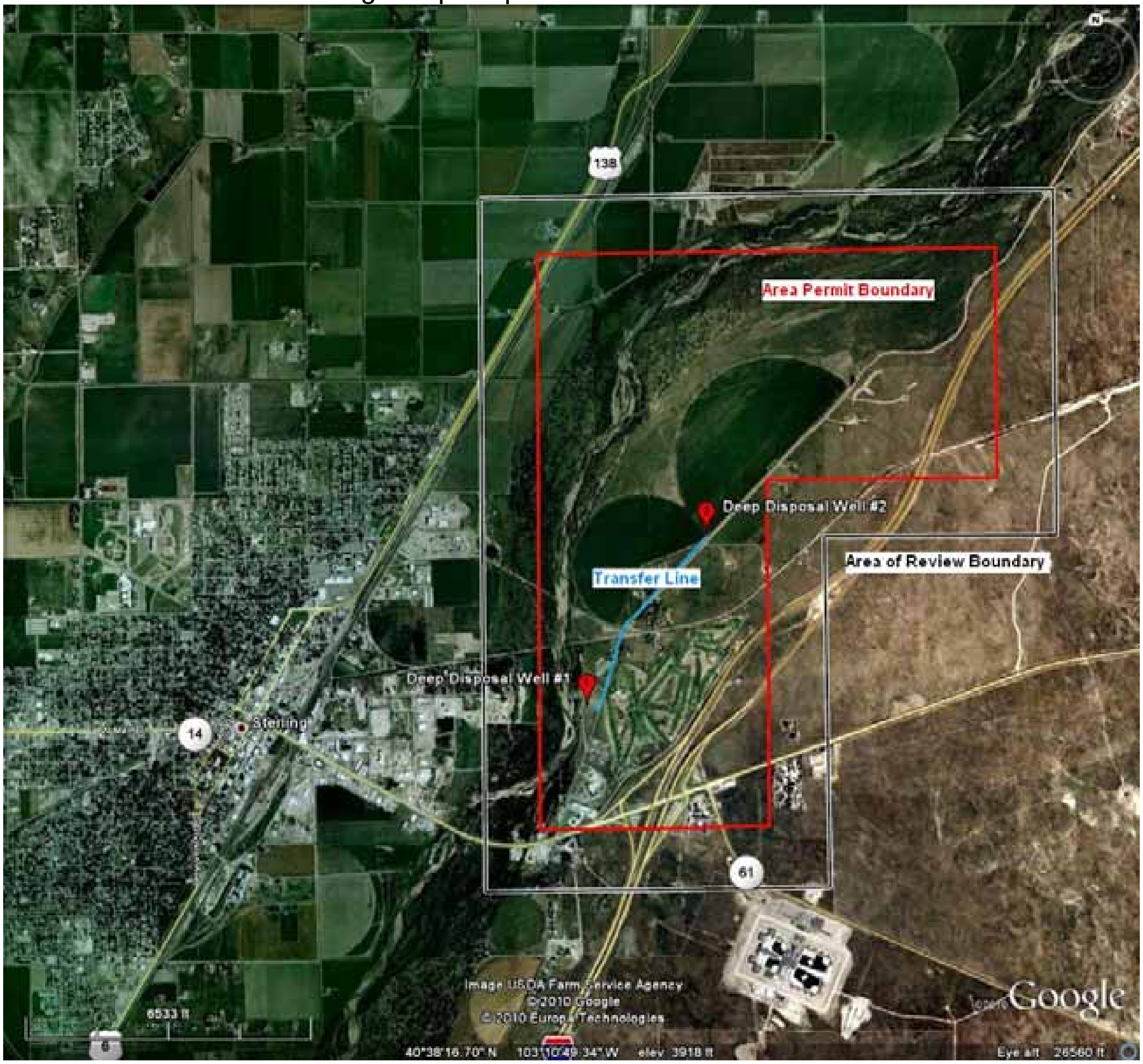
This area permit authorizes the construction and operation of two disposal wells within the project described above. These wells are located as follows:

INJECTION WELL ID AND LOCATION		
Well Name	**UIC Well ID**	**Proposed Location**
Sterling Deep Disposal Well No. 1	CO08741	390 FSL, 1020 FWL, S27, T8N, R52W, Logan County, CO
Sterling Deep Disposal Well No. 2	CO08742	1200 FNL, 1380 FEL, S27, T8N, R52W, Logan County, CO

Sterling Deep Well Area Boundaries



Sterling Deep Disposal Well Area Boundaries



<u>Background</u>

Sterling Existing Water System

The City of Sterling (Sterling) is located within Logan County approximately 120 miles northeast of Denver along Interstate 76 adjacent to the South Platte River. Sterling's city limits encompass 5.38 square miles. Primary water uses in Sterling include residential, commercial, industrial, and government water use, as well as irrigation. The city water system serves a residential population of approximately 13,900 people and 4,965 service taps. Sterling operates under a Council/Manager form of government.

Sterling obtains its drinking water from 15 alluvial wells in two well fields. Drinking water is pumped from the alluvial wells, is chlorinated, and is conveyed to the distribution system. The Sterling water system has four water storage tanks all within the same pressure zone. Two ground level tanks are located in the West Well Field and have water storage volumes of 7.5 million gallons (MG) and 2.0 MG. Two elevated tanks are located within Sterling (North and South Tanks), and both have a water storage volume of 250,000 gallons each. Sterling has a total of 10 MG of storage within the distribution system. There is one booster pump station in the distribution system. The booster pump station serves the prison and hotels located near Interstate 76. There is no dedicated storage for the pressure zone served by the booster pump station. The distribution system includes a network of 85 miles of transmission and distribution lines. Pipe diameters in the system range from 6 inches to 24 inches.

Irrigation for parks, cemeteries, sports fields, and golf courses is supplied by a combination of irrigation-only wells and dedicated irrigation connections to the potable water distribution system. An ethanol plant located in the northeast side of town has two dedicated wells. Water for the ethanol plant is treated with a reverse osmosis (RO) process.

Enforcement Order and Existing Water Quality

The City of Sterling was issued an Enforcement Order (DC-080902-1) by the Colorado Department of Public Health and Environment (CDPHE) on September 2, 2008 related to violations of two National Primary Drinking Water Standards, which are legally enforceable.

1. Sterling's well water supply has elevated concentrations of uranium that exceed the Maximum Contaminant Limit (MCL) of 30 µg/L.
2. Sterling has experienced levels of TTHM, which have occasionally approached and exceeded the MCL of 80 µg/L.

In addition to these violations of the National Primary Drinking Water Standards, Sterling has several other water quality concerns:

1. CDPHE is concerned that the wells should be considered Ground Water Under Direct Influence (GWUDI) of surface water.
2. Several of the wells, in particular those located on the west side of Sterling, have an elevated concentration of nitrate that sometimes approaches, but does not exceed the Primary Standard of 10 mg/L.
3. Sterling's water supply has elevated concentrations of total dissolved solids (TDS), sulfate, and hardness that exceed Secondary Standards (i.e., non-enforceable standards based on aesthetics in lieu of health).

Selected Treatment Process

The alternative selected for implementation in Sterling's water treatment is nanofiltration (NF) with a blend stream filtered. The NF process provides the necessary removal of

Primary Drinking Water contaminants while also treating for Secondary Standards, thereby improving the public acceptability of the finished water, which is a high priority for Sterling.

The projected potable water peak day demand for the year 2022 is 9.6 mgd, and the projected peak day demand for the year 2032 is 10.9 mgd. The capacity of major equipment will be for the year 2022 demands (Phase I). The building, pipelines, and some tanks will be sized for the year 2032 (Buildout) demands.

Role of the Injection Wells

As the treatment plant receives raw water from the city's water production wells, contaminants are removed through a NF process, similar to reverse osmosis (RO). Approximately 80-90% of the volume of raw water emerges from these RO units as product water for distribution to city residents. The remaining 10-20% of the water from the RO units emerges as concentrated brine that will be disposed deep underground via Sterling's Deep Disposal Wells No. 1 and No. 2. All fluids must meet EPA standards for non-hazardous municipal fluids prior to disposal.

More specific details of this process, including a process schematic and specific analytes and methods for fluid analysis are listed later in this Statement of Basis, and in the permit in Appendix D of the permit.

Endangered Species Act Considerations

On April 22, 2010, EPA contacted the U.S. Fish and Wildlife Service (FWS) requesting FWS concurrence on the determination that the Sterling Deep Disposal Well Project would have No Effect on threatened, endangered, proposed, or candidate species A return email was received indicating the FWS position that that this project would have no effect on federally protected species.

National Historic Preservation Act Considerations

Section 106 of the National Historic Preservation Act, as amended, requires that federal agencies, in consultation with the State Historic Preservation Officer (SHPO) , consider the effect of federally funded or permitted undertakings to cultural resources listed, or eligible for listing, in the National Register of Historic Places.

On April 12, 2010, EPA made an inquiry to Mr. Edward C. Nichols, Colorado State Historic Preservation Officer, requesting any information regarding the existence of any historic sites within the permit area boundary. Mr. Nichols responded that in his opinion, no historic properties will be affected by the Sterling Deep Disposal Well Project and the project may proceed without additional cultural resources inventory.

REGIONAL GEOLOGY AND STRATIGRAPHY

The lithology and nomenclature for the geologic formations expected to be encountered when drilling the Sterling Deep Disposal Wells are relatively well defined and consistent due to the number of wells currently drilled through those formations. This includes wells drilled into the shallow alluvial aquifer system of the South Platte River and by the oil and gas wells drilled into the producing zones of Cretaceous period Colorado and Dakota Groups. There are some minor variations in lithological descriptions within the Colorado and Dakota Groups.

For the deeper zones (proposed for injection) of the Permian and Pennsylvanian period, the lithological nomenclature is variable with respect to the time and location at which the well logs were interpreted. This is evident in logged oil and gas wells that were completed in different areas of Logan County over various time frames and for various geologic studies and reports that have attempted to identify regional geology. These lithological descriptions vary between the well logs presented and in regional geologic studies and reports.

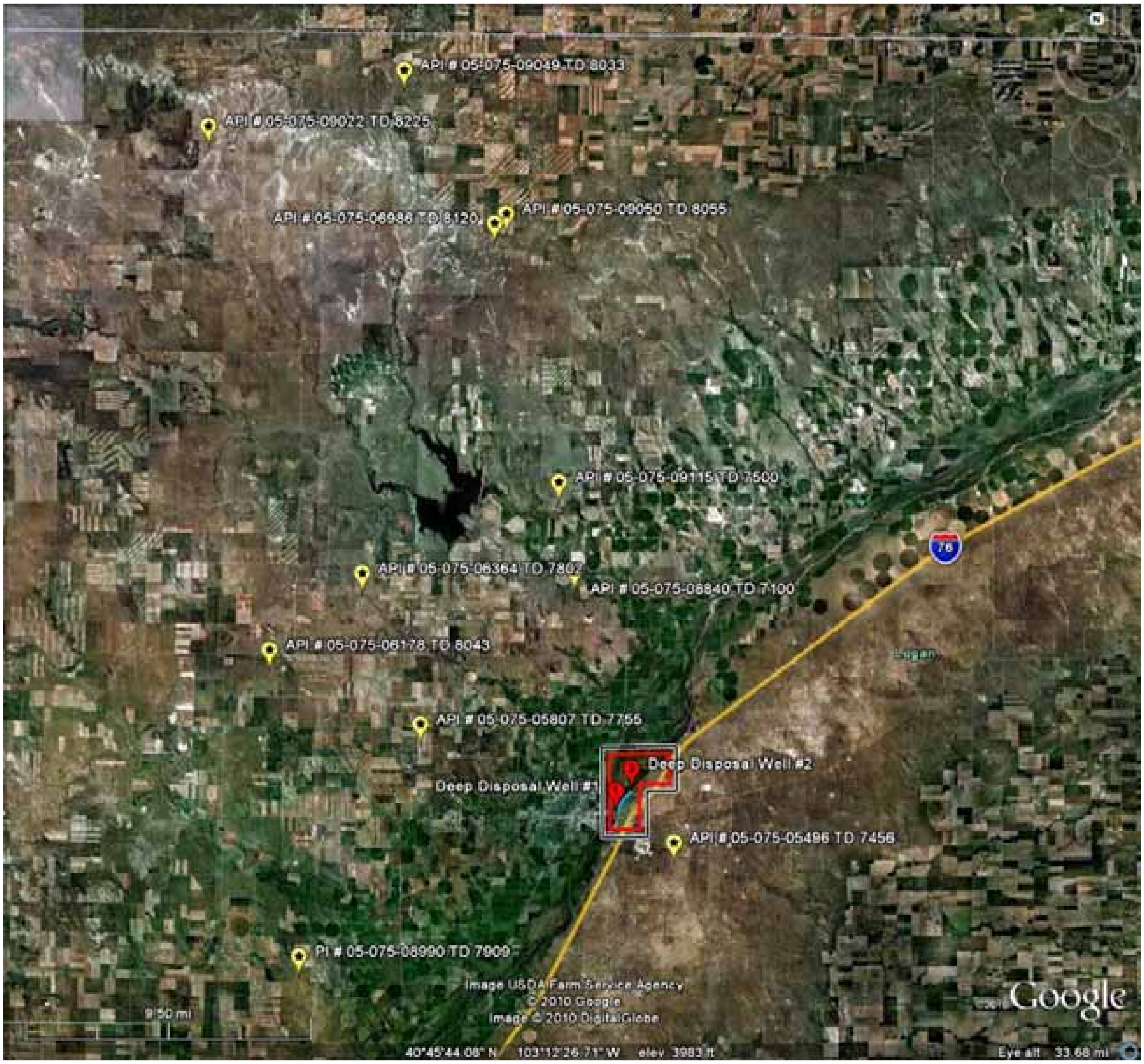
During review of the geologic data for this permit application, Colorado Oil and Gas Conservation Commission (COGCC) records were accessed, which detail the construction details and the geologic formations encountered during the drilling and completion of all oil and gas wells within the project Area of Review (AOR).

Formation names consistent with the Rocky Mountain Association of Geologists (RMAG) publication are used in this Statement of Basis and in the permit for the Sterling injection wells. The geologic formation names which are listed in the COGCC reports, when different, were made consistent with those listed in the RMAG Special Publication No. 2, "Subsurface Cross Sections of Colorado."

The oil and gas wells encountered within the AOR were used to estimate the formations and their depths, which are expected to be encountered during the drilling of the Sterling injection wells. In order to determine the anticipated depths of geologic formations below those encountered in the AOR wells, COGCC records were accessed for the closest wells outside of the AOR, which were drilled to depths approaching that of the proposed injection wells. Formation thickness estimates were calculated from these deeper formations and adjustments were made to those estimates based on the anticipated thickening or thinning of formations as they approach the site of the proposed Sterling injection wells.

The wells used to estimate deeper formation thickness at the site of the Sterling injection wells are shown in the map below. Each well is labeled with the well's API number, and the well's total depth (TD).

Nearby Deep Wells Used to Estimate Formation Thickness



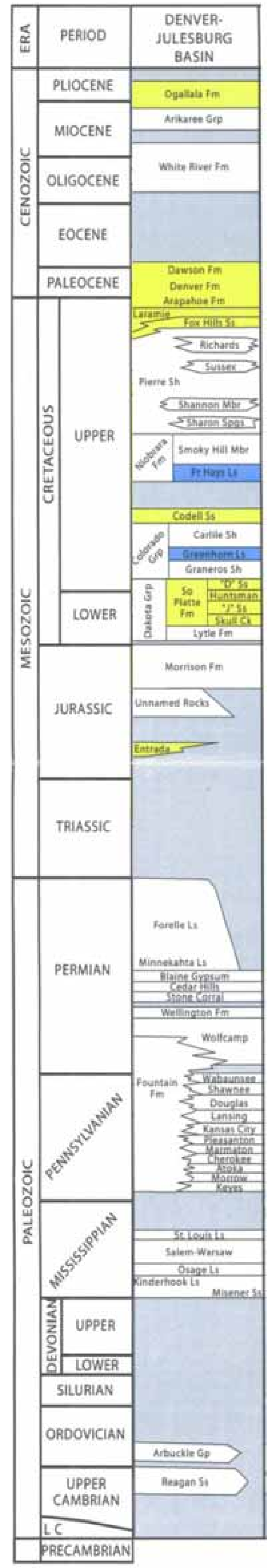
Local Geology and Estimates of Formation Depth

When applicable, formation names were made consistent with those used in RMAG Special Publication No. 2, "Subsurface Cross Sections of Colorado."

Since this document discusses a Major Modification to the original permit subsequent to the drilling and completion of both injection wells, actual formation tops (when identified) from the Sterling No. 1 well will are listed on the following pages. As an aid to this discussion, the figure at right of the page shows a generalized stratigraphic column for the Denver-Julesburg Basin in Colorado. This stratigraphic column, which was provided by Colorado Geologic Survey hydrologist Ralf Topper, closely represents the stratigraphy as listed in the RMAG publication.

Alluvium (0' - 82')

Exposed to the surface and situated on top of the Pierre Shale, the uppermost formation is the Quaternary alluvium within the paleochannel of the South Platte River. The alluvium is continuous along the alignment of the South Platte River and is found over the entire AOR. The South Platte River alluvium is approximately eight miles wide along the river axis at the AOR and generally ranges in depth from 25 to 130 ft. thick. At the site of an oil well adjacent to the proposed Sterling Deep Disposal Well #1, the alluvium is 100 ft. thick.



Pierre (82' - 3420')

The Pierre shale is a widespread silty, dense marine shale extending to a depth of 3461 ft. thick at this project site. The uppermost section of this formation is an olive-gray, clayey marine shale with thin discontinuous lenses of siltstone and very fine grained sandstone. These slightly permeable lenses subcrop the dune sand where the dipping beds are beveled by erosion and may be recharged by precipitation percolating through the dune sand. The thin siltstone and sandstone lenses of the upper Pierre may produce water yields of highly mineralized, soft water.

Niobrara and Codell (3420' - 3865')

Composed of two members, the Ft. Hays and Smoky Hill, the Niobrara is a shale and limestone formation. The facies relationship between the Pierre and Niobrara formations is well shown on RMAG cross-sections. The Codell overlies and marks the top of the Carlile formation.

Carlile (3865' - 3995')

This formation marks the upper member of the Colorado Group and consists of shale. limestone, sandstone and siltstone. RMAG Publication No. 2 mentions the Codell as the upper member of the Carlile formation along with the deeper Fairport and Blue Hill members.

Greenhorn (3995' – 4306')

This shale and limestone formation is composed of three members, the Lincoln, Hartland, and Bridge Creek.

Graneros

The top of the Graneros Formation contains a bentonite, commonly referred to as the X marker. This bentonite has good regional extent and is easily identified on well logs.

Dakota Group (4306' – 4854')

The Cretaceous age Dakota Group lies in the interval between 4295 feet and 4930 feet below ground surface. This group consists of, in descending order, the upper "D," "J," and "O" Sandstone members, the Skull Creek Shale member, and the basal Plainview-Lytle Sandstone member. The Skull Creek Shale is expected to serve as a primary confining zone serving to limit migration of fluids injected into the deeper Mesozoic and Paleozoic targets and the known USDWs existing in the Dakota Group and above.

In the nearby Arco-Sindt #6-15 well (API No. 05-075-09115), the D sand was logged as light gray, fine grained sandstone. The J was logged as having two separate white, fine- to medium-grained sands both with excellent porosity and live oil shows. The Dakota is a regional aquifer that underlies a large area of the western interior of the U.S.   From the information publicly available, from well logs, and from water analyses nearby, the "D," "J," and "O" sands in the Dakota Group are the base of Underground Sources of Drinking Water (USDWs) in the vicinity of the Sterling injection well.

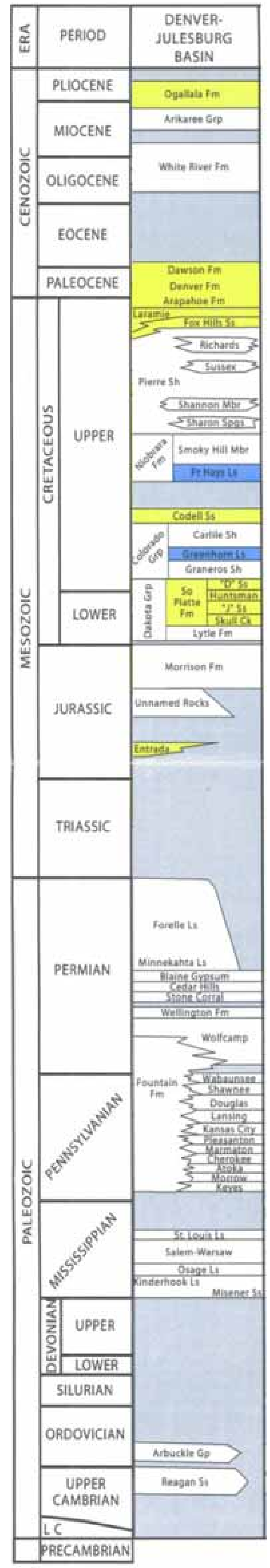
The unconformable systemic boundary between the Lytle Formation and the underlying Jurassic age Morrision Formation is generally indistinguishable on well logs. The base of the lowest sandstone by log signature is commonly used as the boundary of convenience. Both formations are primarily of continental origin and contain common sandstone and shale lithologies.

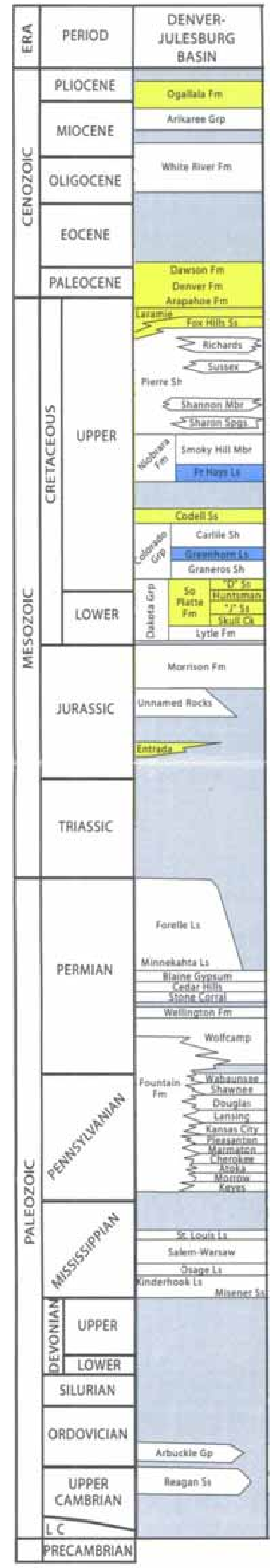
Morrison Formation (4854' – 5030')

The Morrison Formation consists of variegated shale and siltstone, with interbedded limestone and sandstone beds. The Morrison is a very shallow, low-energy marine sequence noted for its vertebrate fauna.

Entrada (If Present)

The Entrada, if present, is a buff to reddish, well-sorted and frequently cross-bedded fine sandstone. It represents beach sands, probably eolian in part; correlative with basal Sundance and Nugget formations of Wyoming.





Blaine

In the nearby Arco-Sindt #6-15 well (API No. 05-075-09115), this Permian salt section had a thickness of 62 feet, comparable to nearby wells of this depth. The Permian Lyons and stray sandstones were also noticed in this well, having good to excellent porosity.

Cedar Hills

Red sandstone, siltstone, and shale with local evaporites. This formation interfingers locally with overlying Blaine evaporites.

Stone Corral (5340' – 5363')

A massive anhydrite, locally dolomitic. Widely recognizable in the D-J Basin, it is the most commonly picked marker in the south-eastern part of the area.

Wolfcamp (5500' - 6038')

Gray to pink limestone, dolomite, anhydrite with interbedded pink to gray or black shale and siltstone. This formation contains a salt section in the north central part of the D-J Basin. The name Wolfcamp is commonly used as a formation name, as are the Group names Chase and Council Grove to the east. In the north-central part of the basin, the Wolfcamp is separated from the Pennsylvanian System by a lateritic horizon called the "Red Shale Marker."

Virgil (6038' - 6184')

Also known as the Shawnee, the Virgil is the top of the Pennsylvanian an is an interbedded tan to brown, fine to very fine-grained sandstone and light colored oolitic limestone. Terrigenous clastic content increases westward. At the site of the nearby Arco-Sindt #6-15 well (API No. 05-075-09115), the Virgil was described as a light brown, medium crystalline limestone with dark brown oil stain. Fair vuggy porosity was seen in samples. A 53 foot core section showed numerous porosity zones without oil shows.

Lansing/Kansas City (6038' - 6396')

Also called the Missourian in some drilling logs, interbedded cream to dark brown, locally cherty and oolitic limestone and dark gray to black shales with some light gray to buff dolomite and occasional traces of tan sandstone. Increasing sandstone and red shales westward. The group names Lansing and Kansas City are applied to these rocks in western Kansas.

Marmaton

Also noted as the top of the Des Moines on some driller's logs, this formation is described as a light gray or tan skeletal limestone in the upper part, characterized by the coral *Chaetetes*; dense gray or tan to brown lime mudstone in the lower part. In the nearby Arco-Sindt #6-15 well (API No. 05-075-09115), this group contains interbedded tight limestones and dark gray to black shales.

Cherokee (6396' - 6631')

Relatively thinly and rhythmically interbedded gray to brown lime mudstones and dark gray shales.

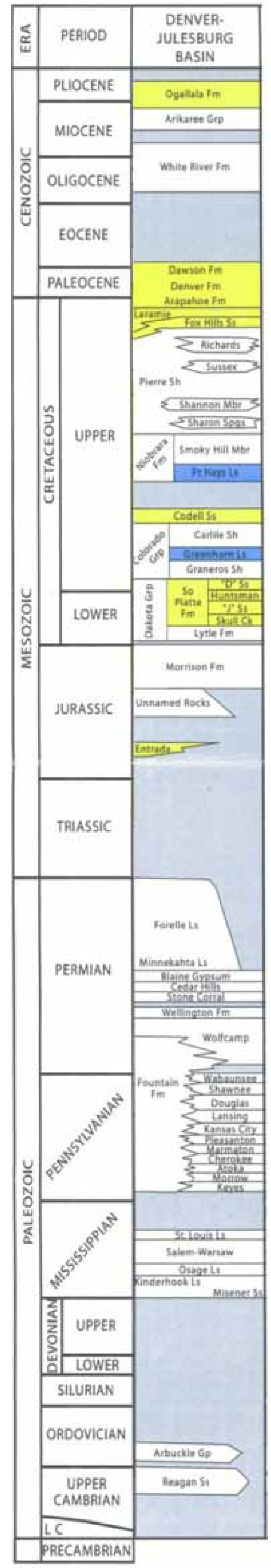
Atoka (6631' - 6802')

Interbedded olive, gray, green, purple and brown shale and dark gray to brown chert. In the nearby Arco Sindt #6-15 well (API No. 05-075-09115), the Atoka section consists of interbedded brown to maroon shales in tight earthy limestones.

Morrow/Keyes (Top at 6802')

Dark gray to black platy shale and green waxy shale, often "pyritic" local sandstone development in the upper part. A basal sandstone, the Keyes, is characteristically poorly sorted, glauconitic, and pyritic. The Keyes frequently contains carbonate detritus reworked from the underlying Mississippian surface.

The Morrow section in the nearby Arco Sindt #6-15 well (API No. 05-075-09115), contains interbedded gray, gray-green and varicolored shales, thin, tight limestones, green fine grained sandstones and thin coal beds. Near the base of the Morrow section a clean porous sandstone is well developed.



PART II. Permit Considerations (40 CFR 146.24)

Proposed Injection Zone(s)
An injection zone is a geological formation, group of formations, or part of a formation that receives fluids through a well. The proposed injection zones are listed in the table below.

Injection will only occur into an injection zone that is separated from USDWs by confining zones, which are free of known open faults or fractures within the Area of Review. The proposed injection zones are the Lytle, Morrison, Lykins, Guadalupe, Salt, Stone Corral, Wellington, Wolfcamp, Virgil, Missourian, Cherokee, Atoka, and Morrow formations between the depths of 4648 ft. and 7185 ft. below ground level.

Injection zones and perforations will only be permitted within a formation:

1) existing below all know USDWs; and,
2) separated from USDWs by a competent confining interval; and,
3) isolated from USDWs by adequate casing and cement.

Suitability for perforated injection intervals were determined based on results of formation water sample analysis, well logging and testing results, and the adequacy of casing and cementing to prevent USDW contamination.

INJECTION ZONE					
Formations	Top (ft)	Base (ft)	TDS (mg/l)	FG (psi/ft)	Exempted? *
Lytle, Morrison, Lykins, Guadalupe, Salt, Stone Corral, Wellington, Wolfcamp, Virgil, Missourian, Cherokee, Atoka, and Morrow	4,648 approx	7,185 approx	>10,000	0.733	N/A

* This item describes the status of any aquifer exemption applicable to this injection zone:

C - Currently Exempted
E - Previously Exempted
P - Proposed
N/A - Not Applicable

Confining Zone(s)
A confining zone is a geological formation, part of a formation, or a group of formations that limits fluid movement out of the injection zone. The 136 ft. thick Skull Creek Shale will serve as the primary confining zone between injection in the lower Mesozoic and Paleozoic Formations and the overlying USDWs. The 3,347 ft. thick Pierre Shale will also serve as ample confinement for the shallower water supply wells currently in use in the area.

CONFINING ZONES			
Name	Top (ft)	Base (ft)	Lithology
Pierre Shale	82	3,429	Marine Shale
Skull Creek Shale	4,512	4,648	Shale

Underground Sources of Drinking Water (USDWs)
Aquifers or the portions thereof which contain less than 10,000 mg/l total dissolved solids (TDS) and are being or could in the future be used as a source of drinking water are considered to be USDWs. Although several formations in the project area have the potential to serve as USDWs, water quality data is rare for formations below the Pierre Shale. The deepest know USDW in the vicinity of the Sterling injection wells is the Dakota group with samples showing TDS values ranging between 4,405 and 8,793 mg/l TDS. There are several formations existing between the Pierre Shale and the Dakota group that could serve as USDWs, however, there is a lack of water quality information within these formations. They will be considered to be USDWs until proven otherwise. For purposes of this permit, the formations considered to be USDWs are shown in the table below:

UNDERGROUND SOURCES OF DRINKING WATER (USDW)			
Formation Name	Top (ft)	Base (ft)	TDS (mg/l)
Dune Sands/Alluvium	0	82	Indicated as < 10,000
Pierre Sand Lenses	100	660	1,200
Niobrara	3,420	3,865	Not provided, assumed < 10,000
Greenhorn Limestone	3,995	4,306	Not provided, assumed < 10,000
Dakota Group	4,306	4,512	4,405 - 8,793

Formations below the Skull Creek Shale were sampled after drilling the Sterling No. 1 well, indicating these formations to contain water in excess of 10,000 mg/l. Permit conditions require that injection take place below the Skull Creek Shale and requires the existence of an adequate confining zone and adequate well isolation (casing and cement) between any injection zone and the lowermost USDW.

Earthquake Hazards Assessment

The shear stress required to trigger a fault is a function of formation pore pressure. A sufficient increase in pore pressure must exist to reduce the shear stress in the rock to cause a failure. To know *a priori* the pressure that will cause a failure is a formidable task that involves installing a seismic network and flow modeling.

The strongest evidence to date that exists that support the statement that injection is low risk is the current UIC well injection activity in the Wattenberg and Greeley oil fields through which five major wrench faults are located. There are nine saltwater disposal wells, eight enhanced recovery wells, and one Class I injection that currently inject into the Lyons formation and deeper. To date, there has not been any reported seismic activity as a result of these injection activities. Review of the maximum allowable injection pressure (MAIP) and injection history shows that the wells have been authorized to inject up to 3700 psi, however, with the exception of one well actual injection pressure has been below 2500 psi.

Even though the potential for earthquake activity resulting from injection activity is considered low, the permittee, using U.S. Geological Survey (USGS) Earthquake Hazards Program, will be required to monitor earthquakes in the vicinity of the injection wells and to report these occurrences to EPA following detection of any earthquakes in the vicinity. Monitoring and reporting frequency is set as follows:

Continuously
Establish and monitor, using the USGS Earthquake Hazards Program, any seismic activity within fifty miles of the project boundary. Detection of an earthquake within two miles of the project boundary will require ceasing injection immediately and reporting to EPA. Injection activities may be resumed after approval from EPA.

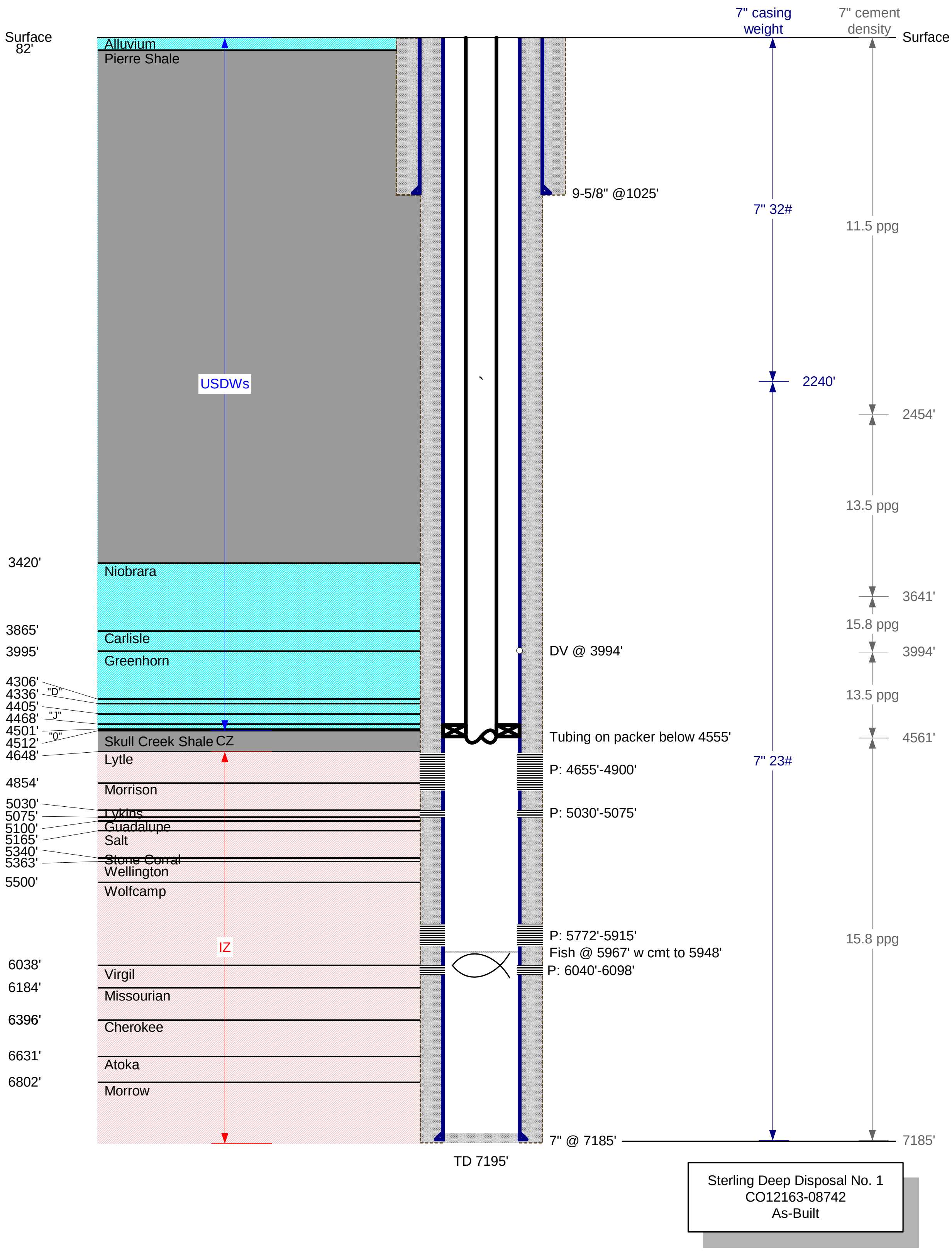
Quarterly
Report all seismic activity within fifty miles of the project boundary to EPA.

PART III. Well Construction, Logging, and Testing

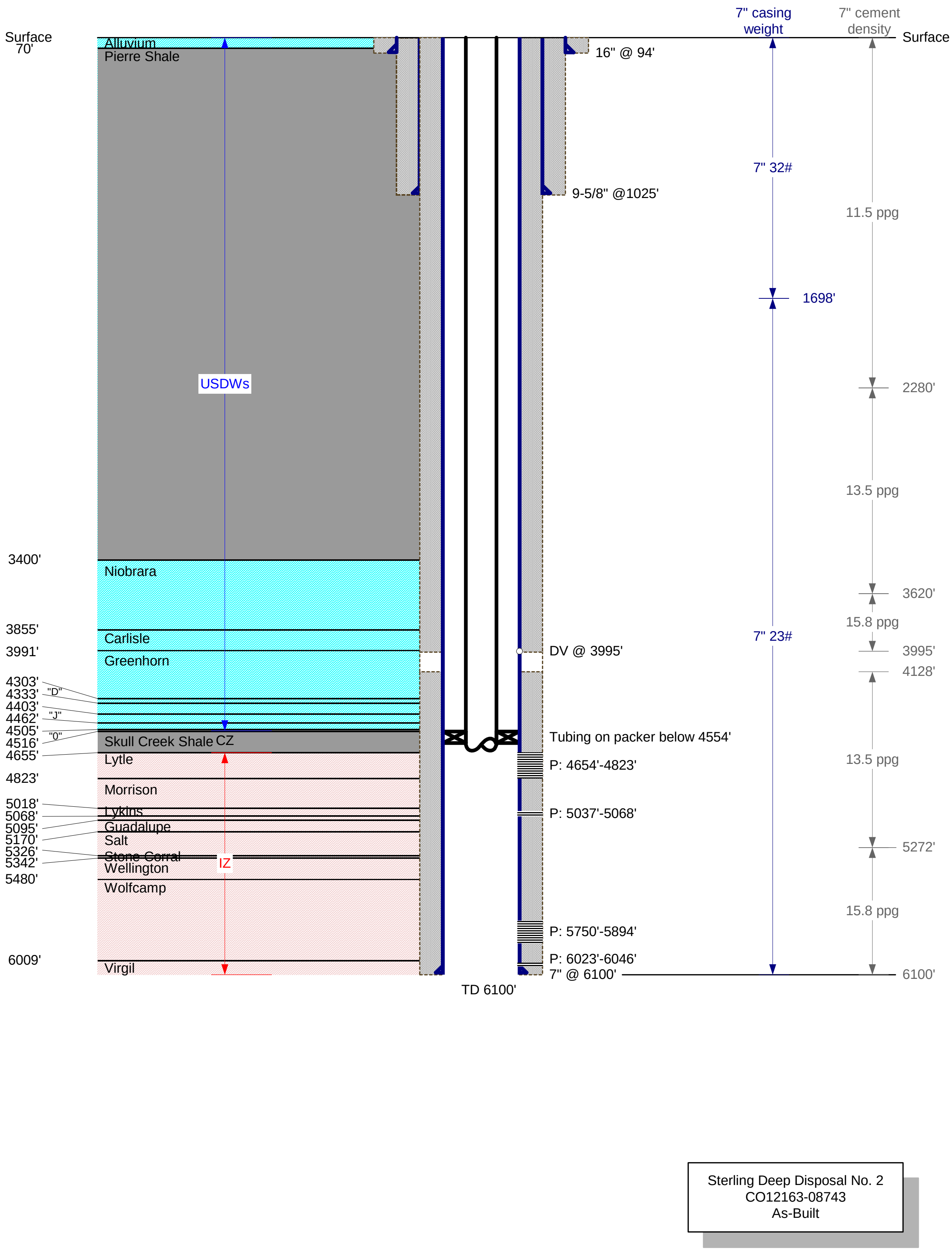
Well Construction Requirements

The approved well completion plans are incorporated into the Permit as APPENDIX A and are binding on the Permittee. Modification of these approved plans is allowed under 40 CFR 144.52(a)(1) provided that approval is obtained from the Director prior to actual modification.

Casing and Cementing
The well construction plans were evaluated and were determined to be in conformance with standard practices and guidelines that ensure well injection does not result in the movement of fluids into USDWs. Surface casing is required to be installed from the surface to approximately 1000 ft. and was fully cemented from bottom to top. Injection casing is required from the surface to the well's total depth, also fully cemented from bottom to top. Cement quality for both casing strings was verified by cement bond or cement evaluation type logs. Construction and completion details for the injection wells are shown in the permit as APPENDIX A, and in the schematics below.



7" casing weight
7" cement density
Surface
82'
Alluvium
Pierre Shale
Surface
9-5/8" @1025'
7" 32#
11.5 ppg
USDWs
2240'
2454'
13.5 ppg
3420'
Niobrara
3641'
3865'
Carlisle
15.8 ppg
3995'
Greenhorn
DV @ 3994'
3994'
4306'
4336'
"D"
4405'
4468'
"J"
4501'
4512'
"O"
4648'
13.5 ppg
Skull Creek Shale CZ
Tubing on packer below 4555'
4561'
Lytle
P: 4655'-4900'
7" 23#
4854'
Morrison
5030'
5075'
5100'
5165'
5340'
5363'
Lykins
Guadalupe
Salt
P: 5030'-5075'
Stone Corral
Wellington
5500'
Wolfcamp
IZ
P: 5772'-5915'
Fish @ 5967' w cmt to 5948'
P: 6040'-6098'
15.8 ppg
6038'
Virgil
6184'
Missourian
6396'
Cherokee
6631'
Atoka
6802'
Morrow
7" @ 7185'
7185'
TD 7195'
Sterling Deep Disposal No. 1
CO12163-08742
As-Built



Tubing and Packer

Injection shall take place only through tubing installed on a packer. The packer will be set no more than 100‘ above the uppermost perforated or open hole interval. The tubing and packer shall be designed to prevent injection fluid from coming into contact with the outermost casing and to provide for monitoring the well’s mechanical integrity.

Tubing-Casing Annulus (TCA)
The TCA allows for pressure monitoring to assess the integrity of the casing, tubing and packer and allows for periodic pressure-testing for mechanical integrity and leak detection. The TCA will be filled with fresh water treated with a corrosion inhibitor or other fluid approved by the Director and will be maintained at zero pressure during well operation.

Injection Well Monitoring Devices
The Permittee shall install and maintain in good operating condition:

(a) Sampling taps conveniently located and isolated by shut-off valves, to enable collection of representative samples of the fluid in the injection tubing and in the tubing-casing annulus; and

(b) One-half (1/2) inch female iron pipe fitting, isolated by shut-off valves and located at the wellhead at a conveniently accessible location, for the attachment of a pressure gauge capable of monitoring pressures ranging from normal operating pressures up to the Maximum Allowable Injection Pressure specified in APPENDIX C of the permit:

(i) on the injection tubing; and
(ii) on the tubing-casing annulus (TCA); and

(c) Continuous recording devices located to monitor and record injection pressure, annulus pressure, flow rate, and volume

(d) An automated shut-off device set to shut-off the injection pump when or before the Maximum Allowable Injection Pressure specified in APPENDIX C is reached at the wellhead; and

(e) A cumulative volume recorder attached to the injection line.

All sampling and measurement taken for monitoring must be representative of the monitored activity.

Well Construction Requirements: Sterling Injection Wells No. 1 and No. 2				
Casing Type	Hole Size (in)	Casing Size (in)	Cased Interval (ft)	Cemented Interval (ft)
Surface	12-1/4	9-5/8	0-1000	0-1000
Injection	8-3/4	7	0-TD	0-TD

Well Logging and Testing Requirements (40 CFR 146.12(d) and (e))

For the Sterling injection wells, the following logs and tests will be run:

- All open hole intervals will be evaluated with Dual Induction, Formation Density, Compensated Neutron, Microlog, Spontaneous Potential, Gamma Ray, and Caliper logs. In addition, the open hole section for the Injection Casing will be evaluated with a fracture finder log.
- All casing strings will be evaluated with cement bond or cement evaluation type logs from TD to surface in order to confirm the existence and quality of cement behind each string.
- A Temperature Survey will be conducted to establish a baseline temperature gradient for the well. Temperature Surveys will be required at least once every five years as a demonstration of Part II Mechanical Integrity.
- Periodic Radioactive Tracer Surveys may be required to provide additional information regarding movement of fluids behind casing.
- A Standard Annulus Pressure Test to prove Part I Mechanical Integrity.
- Injection formation pore pressure.
- A Step Rate Injectivity Test will be used to determine injection formation fracture gradient.
- Injection formation pore pressure.
- Injection formation water analysis showing Total Dissolved Solids (TDS), pH, Specific Gravity, and Conductivity.
- Once prior to injection and annually after the well begins operation, pressure fall-off tests will be conducted to monitor the pressure buildup in the injection zone.

PART IV. Area of Review, Corrective Action Plan (40 CFR 144.55)

Area of Review
The Applicant has identified the location of all known wells within the Area of Review (AOR). The AOR for this area permit is a fixed width of (1/4) mile surrounding the project area. In addition to the two (2) proposed Class I injection wells and twelve (12) oil and gas wells existing within the AOR, two hundred twenty seven (227) shallow water supply wells also exist within the sections included within the AOR.

WATER WELLS
The data for the water supply wells was provided by the Colorado State Engineer's office. Generalized location data for these wells precludes them from being accurately plotted on the map, consequently the research included all wells located within each section included within the AOR. The depth of these wells range between 25 ft and 660 ft, no impact to these wells is expected from the injection activities occurring below 4648 ft.

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S13	118251	NE, NE, Sect. 13, T8N, R52W, 1200N, 560E	Alluvium	53	COMMERCIAL
S13	118251	NE, NW, Sect. 13, T8N, R52W, 1240N, 2070E	Alluvium	80	MUNICIPAL
S13	223997	NE, SW, Sect. 13, T8N, R52W, 1680N, 2763W	Alluvium	103	DOMESTIC, STOCK
S13	24845	NW, NW, Sect. 13, T8N, R52W	Alluvium	55	DOMESTIC
S13	120027	NW, SE, Sect. 13, T8N, R52W, 2049N, 2501E	Alluvium	--	OTHER
S13	120024	SE, NE, Sect. 13, T8N, R52W, 2415S, 6E	Alluvium	73	OTHER
S13	120022	SE, NW, Sect. 13, T8N, R52W	Alluvium	61	OTHER
S13	120026	SE, NW, Sect. 13,T8N, R52W, 1899S, 2061E	Alluvium	67	OTHER
S13	219811	SE, NW, Sect. 13, T8N, R52W, 2600S, 2600E	Alluvium	72	DOMESTIC, STOCK
S13	120028	SE, SE, Sect. 13, T8N, R52W, 881S, 7E	Alluvium	109	OTHER
S13	120025	SE, SW, Sect. 13, T8N, R52W, 796S, 1372E	Alluvium	73	OTHER
S13	274354	SW, NE, Sect. 13, T8N, R52W, 1344S, 1529W	Quaternary Alluvium	75	DOMESTIC, STOCK
S13	120029	SW, SE, Sect. 13, T8N, R52W, 76S, 1528W	Alluvium	73	OTHER
S14	24756	NE, NW, Sect. 14, T8N, 52W	Alluvium	71	DOMESTIC
S14	70795	NE, NW, Sect. 14, T8N, R52W, 380N, 2650W	Alluvium	400	HOUSEHOLD USE ONLY
S14	24844	NW, NE, Sect. 14, T8N, R52W	Alluvium	72	DOMESTIC
S14	6208	NW, NE, Sect. 14, T8N, R52W	Alluvium	80	IRRIGATION
S14	59859	NW, NW, Sect. 14, T8N, R52W, 1307N, 1309W	Alluvium	--	AUGMENTATION
S14	16080	SW, NW, Sect. 14, T8N, R52W, 2255S, 25W	Alluvium	80	STOCK
S14	16080	SW, NW, Sect. 14, T8N, R52W	Alluvium	60	IRRIGATION
S14	94374	SW, NW, Sect. 14, T8N, R52W, 2255S, 40E	Alluvium	--	STOCK
S15	24755	SE, SE, Sect. 15, T8N, R52W	Alluvium	--	Domestic
S15	30754-F	SE, SE, Sect. 15, T8N, R52W, 1162S, 1258E	Alluvium	83	Domestic
S15	13728	SE, SE, Sect. 15, T8N, R52W	Alluvium	60	Stock
S15	25306	SW, SE, Sect. 15, T8N, R52W, 660S, 1340E	Alluvium	78	Stock
S15	125671	SW, SE, Sect. 15, T8N, R52W, 1210S, 2110E	Alluvium	88	Household Use Only
S16	119014	SE, SE, Sect. 16, T8N, R52W	Alluvium	--	--
S21	99792	NE, NE, Sect. 21, T8N, R52W, 1267N, 717E	Alluvium	87	Domestic, Stock
S21	99792	NE, NE, Sect. 21, T8N, R52W, 1267N, 717E	Alluvium	85	Domestic, Stock
S21	184848	NE, NE, Sect. 21, T8N, R52W, 100N, 120E	Alluvium	106	Domestic
S21	1497-R	SE, NE, Sect. 21, T8N, R52W	Alluvium	110	Irrigation
S21	81878	SE, NE, Sect. 21, T8N, R52W	Alluvium	--	Stock

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S21	81878	SE, NE, Sect. 21, T8N, R52W, 2440N, 1300E	Alluvium	65	Stock
S22	10128	NW, NE, Sect. 22, T8N, R52W	Alluvium	50	Stock
S22	10129	NW, NE, Sect. 22, T8N, R52W	Alluvium	45	Stock
S22	111647	NE, NW, Sect. 22, T8N, R52W, 200N, 1500W	Ogallala	--	Domestic
S22	111647	NE, NW, Sect. 22, T8N, R52W, 200N, 1510W	Alluvium	50	Domestic
S22	111647	NE, NW, Sect. 22, T8N, R52W, 200N, 1500W	Alluvium	70	Domestic
S22	168703	NW, NW, Sect. 22, T8N, R52W, 1250N, 250W	Alluvium	99	Domestic, Stock
S22	168703	NW, NW, Sect. 22, T8N, R52W, 1270N, 250W	Alluvium	50	Domestic, Stock
S22	26428	SE, NW, Sect. 22, T8N, R52W	Alluvium	50	Dewatering
S22	26379	SE, NW, Sect. 22, T8N, R52W	Alluvium	60	Dewatering
S22	60535-F	SW, NW, Sect. 22, T8N, R52W, 1600N, 1300W	Alluvium	--	Recharge
S22	38239-MH	SE, SE, Sect. 22, T8N, R52W	Alluvium	--	Other
S22	3141-F	NE, SE, Sect. 22, T8N, R52W, 5300N, 1704W	Alluvium	74	Irrigation
S23	166-WCB	Sect. 23, T8N, R52W	Alluvium	60	--
S23	103103	NE, SW, Sect. 23, T8N, R52W, 2444S, 1986W	Ogallala	65	Domestic
S23	103103	NE, SW, Sect. 23, T8N, R52W	Alluvium	--	Domestic
S23	143413	NE, SW, Sect. 23, T8N, R52W	Alluvium	--	Domestic
S23	38241-MH	NW, SW, Sect. 23, T8N, R52W	Alluvium	--	Monitoring
S23	206620	SE, SW, Sect. 23, T8N, R52W, 1033S, 3670E	Alluvium	78	Domestic, Stock
S23	174955	SE, SW, Sect. 23, T8N, R52W, 1233S, 3490E	Alluvium	40	Stock
S23	38240-MH	SW, SW, Sect. 23, T8N, R52W	Alluvium	--	Monitoring
S23	108307	SW, SW, Sect. 23, T8N, R52W	Alluvium	--	Stock
S23	38266	SW, SW, Sect. 23, T8N, R52W	Alluvium	57	Domestic
S24	120023	NE, NE, Sect. 24, T8N, R52W, 306N, 684E	Alluvium	134	OTHER
S24	124602	NE, NE, Sect. 24, T8N, R52W, 1066N, 209E	Alluvium	63	OTHER
S24	120030	NE, NW, Sect. 24, T8N, R52W, 391N, 2046E	Alluvium	93	OTHER
S24	124603	NE, SE, Sect. 24, T8N, R52W, 1636N, 1271E	Alluvium	135	OTHER
S24	124596	NW, SE, Sect. 24, T8N, R52W, 1767N, 2765E	Alluvium	104	OTHER
S24	215747	SW, NE, Sect. 24, T8N, R52W, 2100S, 2300W	Alluvium	130	COMMERCIAL
S25	13473	NW, SW, Sect. 25, T8N, R52W	Alluvium	30	DOMESTIC
S25	14495	SE, NE, Sect. 25, T8N, R52W	Alluvium	200	DOMESTIC
S26	13690-F	NE, NW, Sect. 26, T8N, R52W	Alluvium	78	Commercial

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S26	13691-F	SW, NW, Sect. 26, T8N, R52W	Alluvium	72	Commercial
S26	138274	NW, NW, Sect. 26, T8N, R52W, 500N, 500W	Alluvium	50	Domestic, Stock
S26	237185	NW, NW, Sect. 26, T8N, R52W, 500N, 500W	Alluvium	50	Domestic, Stock
S27	38238	NE, NE, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	237209	SE, NE, Sect. 27, T8N, R52W, 2020N, 70W	Alluvium	38	Domestic, Stock
S27	174956	SE, NE, Sect. 27, T8N, R52W, 2435N, 135W	Alluvium	40	Stock
S27	236200	SE, NE, Sect. 27, T8N, R52W, 1471N, 1297W	Alluvium	60	Domestic, Stock
S27	249717	SW, NE, Sect. 27, T8N, R52W, 2042N, 2017W	Alluvium	80	Household Use Only
S27	16049	SW, NE, Sect. 27, T8N, R52W	Alluvium	72	Domestic
S27	44131	NE, NW, Sect. 27, T8N, R52W	Alluvium	75	Domestic, Stock
S27	44347	SE, NW, Sect. 27, T8N, R52W	Alluvium	75	Stock
S27	38237-MH	SE, NW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	8460-R	NE, SE, Sect. 27, T8N, R52W, 1759S, 713E	Alluvium	104	Municipal
S27	8460-R	NE, SE, Sect. 27, T8N, R52W	Alluvium	95	Municipal
S27	8463-R	NE, SE, Sect. 27, T8N, R52W, 2007S, 397E	Alluvium	86	Municipal
S27	8465-R	NE, SE, Sect. 27, T8N, R52W, 2007S, 397E	Alluvium	86	Municipal
S27	8463-R	NE, SE, Sect. 27, T8N, R52W, 2007S, 397E	Alluvium	91	Municipal
S27	44452-MH	NE, SE, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	5505-F	NE, SE, Sect. 27, T8N, R52W	Alluvium	60	Irrigation
S27	8461-R	SE, SE, Sect. 27, T8N, R52W, 788S, 771E	Alluvium	--	Municipal
S27	8461-R	SE, SE, Sect. 27, T8N, R52W	Alluvium	110	Municipal
S27	22252	SE, SE, Sect. 27, T8N, R52W	Alluvium	43	Stock
S27	5506-F	SE, SE, Sect. 27, T8N, R52W	Alluvium	60	Irrigation
S27	8462-F	SW, SE, Sect. 27, T8N, R52W, 288S, 1475E	Alluvium	88	Municipal, Augmented
S27	8462-F	SW, SE, Sect. 27, T8N, R52W	Alluvium	87	Municipal, Augmented
S27	25200	NE, SW, Sect. 27, T8N, R52W, 1574S, 1539W	Alluvium	76	Domestic
S27	61062-F	NE, SW, Sect. 27, T8N, R52W, 1574S, 1470W	Alluvium	81	Industrial, Municipal
S27	38236-MH	NE, SW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	23909	NE, SW, Sect. 27, T8N, R52W	Alluvium	60	Domestic
S27	25588-F	NE, SW, Sect. 27, T8N, R52W, 2100S, 1900W	Alluvium	--	Other
S27	25589-F	NE, SW, Sect. 27, T8N, R52W	Alluvium	--	Other
S27	43668-MH	NE, SW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S27	17-AD	NW, SW, Sect. 27, T8N, R52W	Alluvium	--	Irrigation
S27	25200	NW, SW, Sect. 27, T8N, R52W	Alluvium	40	Domestic
S27	61061-F	NW, SW, Sect. 27, T8N, R52W, 2520S, 800W	Alluvium	81	Industrial, Municipal
S27	43669-MH	NW, SW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	38153-MH	NW, SW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	54321-F	NW, SW, Sect. 27, T8N, R52W, 2100S, 700W	Alluvium	0	Irrigation
S27	--	SE, SW, Sect. 27, T8N, R52W, 230S, 1890W	Alluvium	--	Industrial, Municipal
S27	18104-F	SE, SW, Sect. 27, T8N, R52W, 230S, 1890W	Alluvium	58	Irrigation
S27	133037	SE, SW, Sect. 27, T8N, R52W, 840S, 1820W	Alluvium	70	Commercial
S27	86118	SE, SW, Sect. 27, T8N, R52W, 700S, 2010W	Alluvium	50	Domestic
S27	16498-F	SE, SW, Sect. 27, T8N, R52W, 230S, 1890W	Alluvium	--	Irrigation
S27	26960-MH	SE, SW, Sect. 27, T8N, R52W	Alluvium	--	Monitoring
S27	--	SE, SW, Sect. 27, T8N, R52W	Alluvium	--	Commercial
S27	46195-F	SE, SW, Sect. 27, T8N, R52W, 880S, 1770W	Alluvium	--	Municipal
S27	13645-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	25	Industrial
S27	13646-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	25	Industrial
S27	13647-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	50	Industrial
S27	13648-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	50	Industrial
S27	13649-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	50	Industrial
S27	13650-F	SW, SW, Sect. 27, T8N, R52W	Alluvium	40	Industrial
S28	62618-F	SE, NE, Sect. 28, T8N, R52W	Alluvium	59	Other
S28	13651-F	SE, SE, Sect. 28, T8N, R52W	Alluvium	40	Industrial
S28	13644-F	SE, SE, Sect. 28, T8N, R52W	Alluvium	40	Industrial
S28	59850-F	SE, SE, Sect. 28, T8N, R52W,400S, 1175E	Alluvium	--	Industrial, Commercial
S28	13651-F-R	SE, SE, Sect. 28, T8N, R52W,400S, 1175E	Alluvium	77	Industrial, Commercial
S33	66811	Sect. 33, T8N, R52W	Alluvium	--	OTHER, GRAVEL PIT
S33	72469	Sect. 33, T8N, R52W, 1230N, 170W	Alluvium	--	DOMESTIC
S33	32731	NE, NE, Sect. 33, T8N, R52W	Alluvium	25	OTHER, MONITORING WELL
S33	31978	NE, NE, Sect. 33, T8N, R52W	Alluvium	--	OTHER, MONITORING WELL
S33	13023	NE, NW, Sect. 33, T8N, R52W	Alluvium	72	STOCK
S33	13022	NE, NW, Sect. 33, T8N, R52W, 995N, 1725E	Alluvium	72	STOCK
S33	1597	NE, NW, Sect. 33, T8N, R52W	Alluvium	--	COMMERCIAL

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S33	38155	NE, SE, Sect. 33, T8N, R52W	Alluvium	--	OTHER
S33	39918	NE, SE, Sect. 33, T8N, R52W	Alluvium	--	OTHER
S33	33037	NE, SE, Sect. 33, T8N, R52W	Alluvium	--	OTHER
S33	54322	NE, SE, Sect. 33, T8N, R52W, 2625N, 300E	Alluvium	0	IRRIGATION, OTHER
S33	34893	NE, SE, Sect. 33, T8N, R52W	Alluvium	--	OTHER, MONITORING WELL
S33	228944	NE, SW, Sect. 33, T8N, R52W, 2114N, 2483E	Alluvium	0	STOCK
S33	11801	NE, SW, Sect. 33, T8N, R52W	Alluvium	80	IRRIGATION
S33	207862	NW, NE,Sect. 33, T8N, R52W, 1225N, 1375W	Alluvium	--	OTHER, MONITORING WELL
S33	49841	NW, NE, Sect. 33, T8N, R52W, 1200N, 1400W	Alluvium	--	OTHER
S33	207865	NW, NE,Sect. 33, T8N, R52W, 1350N, 1500W	Alluvium	--	OTHER, MONITORING WELL
S33	207864	NW, NE,Sect. 33, T8N, R52W, 1350N, 1425W	Alluvium	--	OTHER, MONITORING WELL
S33	2207	NW, NE, Sect. 33, T8N, R52W, 1056N, 1795W	Alluvium	80	MUNICIPAL
S33	19970	NW, NE, Sect. 33, T8N, R52W	Alluvium	14	OTHER, MONITORING WELL
S33	12945	NW, NE, Sect. 33, T8N, R52W	Alluvium	75	STOCK
S33	39451	NW, NE, Sect. 33, T8N, R52W	Alluvium	75	STOCK
S33	207861	NW, NE, Sect. 33 ,T8N, R52W, 1275N, 1450W	Alluvium	--	OTHER, MONITORING WELL
S33	207870	NW, NE, Sect. 33, T8N, R52W,1050,N,1400,W	Alluvium	--	OTHER, MONITORING WELL
S33	207860	NW, NE, Sect. 33, T8N, R52W,975,N,1400,W	Alluvium	--	OTHER, MONITORING WELL
S33	22192	NW, NE, Sect. 33, T8N, R52W,628,N,2429,W	Alluvium	--	COMMERCIAL
S33	207868	NW, NE, Sect. 33, T8N, R52W,1450,N,1350,W	Alluvium	--	OTHER, MONITORING WELL
S33	207866	NW, NE, Sect. 33, T8N, R52W,1275,N,1500,W	Alluvium	--	OTHER, MONITORING WELL
S33	12947	NW, NE, Sect. 33, T8N, R52W	Alluvium	79	STOCK
S33	207937	NW, NE, Sect. 33, T8N, R52W, 1200N, 1500W	Alluvium	--	OTHER, MONITORING WELL
S33	207867	NW, NE, Sect. 33, T8N, R52W, 1200N, 1450W	Alluvium	--	OTHER, MONITORING WELL
S33	12946	NW, NE, Sect. 33, T8N, R52W	Alluvium	76	STOCK
S33	27652	NW, NW, Sect. 33, T8N, R52W	Alluvium	88	DOMESTIC
S33	36621	NW, NW, Sect. 33, T8N, R52W	Alluvium	14	OTHER, MONITORING WELL
S33	30766	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	48222	NW, NW, Sect. 33, T8N, R52W	Alluvium	52	DOMESTIC
S33	31749	NW, NW, Sect. 33, T8N, R52W	Alluvium	--	OTHER
S33	30767	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30765	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S33	30764-M	NW, NW, Sect. 33 T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	207869	NW, NW, Sect. 33, T8N, R52W, 1200N, 1300W	Alluvium	--	OTHER, MONITORING WELL
S33	30770-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	22	OTHER, MONITORING WELL
S33	30761-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30769-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30771-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30768-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30760-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	30763-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	15	OTHER, MONITORING WELL
S33	207863	NW, NW, Sect. 33, T8N, R52W, 1050N, 1300W	Alluvium	--	OTHER, MONITORING WELL
S33	30762-M	NW, NW, Sect. 33, T8N, R52W	Alluvium	--	OTHER, MONITORING WELL
S33	20407	NW, SE, Sect. 33, T8N, R52W	Alluvium	74	STOCK
S33	5868-R	NW, SW, Sect. 33, T8N, R52W, 2616N, 68W	Alluvium	83	IRRIGATION
S33	5868-RR	NW, SW, Sect. 33, T8N, R52W, 2616N, 68W	Alluvium	109	IRRIGATION
S33	--	SE, NE, Sect. 33, T8N, R52W	Alluvium	--	DOMESTIC
S33	11693	SE, NE, Sect. 33, T8N, R52W	Alluvium	30	DOMESTIC, STOCK
S33	38156-MH	SE, NE, Sect. 33, T8N, R52W	Alluvium	--	OTHER, MONITORING WELL
S33	22022	SE, NE, Sect. 33, T8N, R52W	Alluvium	34	DOMESTIC
S33	23166	SE, SE, Sect. 33, T8N, R52W	Alluvium	77	STOCK
S33	3341-F	SE, SE, Sect. 33, T8N, R52W	Alluvium	45	IRRIGATION
S33	10073	SE, SE, Sect. 33, T8N, R52W	Alluvium	154	DOMESTIC
S33	7219-RR	SE, SE, Sect. 33, T8N, R52W	Alluvium	--	IRRIGATION
S33	82266	SE, SW, Sect. 33, T8N, R52W, 1S, 1443E	Alluvium	--	DOMESTIC, STOCK
S33	49750	SW, NE, Sect. 33, T8N, R52W	Alluvium	110	STOCK
S34	20433-MH	NE, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	32955-MH	NE, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	8464-R	NW, NE, Sect. 34, T8N, R52W	Alluvium	--	Municipal
S34	8464-R	NW, NE, Sect. 34, T8N, R52W	Alluvium	114	Municipal
S34	8464-R	NW, NE, Sect. 34, T8N, R52W	Alluvium	--	Municipal
S34	8463-R	NW, NE, Sect. 34, T8N, R52W	Alluvium	91	Municipal
S34	13381-F	SE, NE, Sect. 34, T8N, R52W	Alluvium	97	Commercial
S34	8465-R	SE, NE, Sect. 34, T8N, R52W	Alluvium	78	Municipal

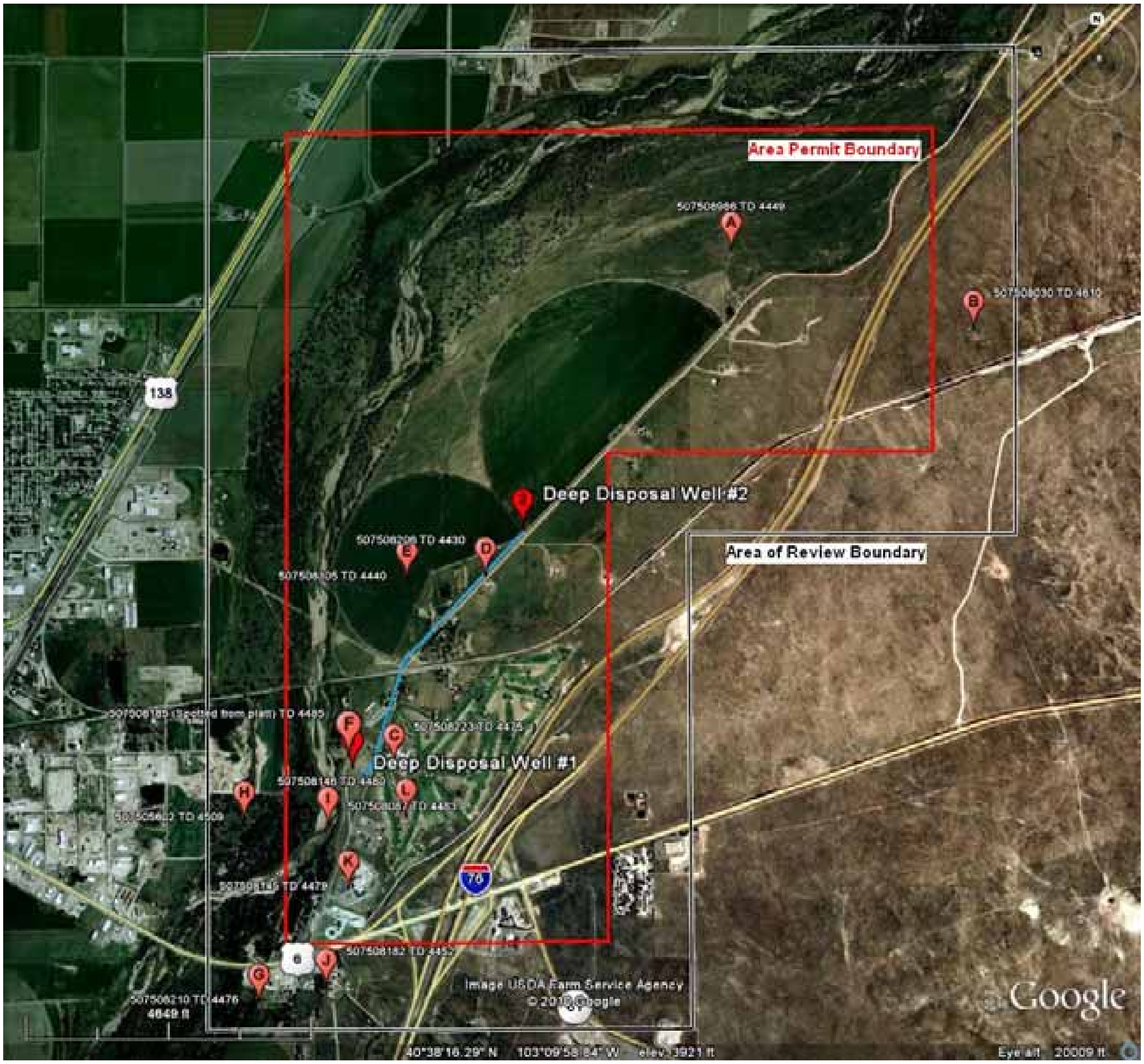
Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S34	918-AD	SE, NE, Sect. 34, T8N, R52W	Alluvium	--	Commercial
S34	45614	SW, NE, Sect. 34, T8N, R52W, 2285N, 1955E	Alluvium	98	Domestic
S34	12733-F	NW, SE, Sect. 34, T8N, R52W, 2340S, 1777E	Alluvium	100	Commercial
S34	8467-R	NW, SW, Sect. 34, T8N, R52W	Alluvium	65	Municipal
S34	--	NW, SW, Sect. 34, T8N, R52W, 1385S, 620W	Alluvium	--	Industrial, Municipal
S34	69547	NW, SW, Sect. 34, T8N, R52W, 1758S, 378W	Alluvium	60	Domestic
S34	20435-MH	NW, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	39545-MH	NE, NW, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	5494-F	NE, NW, Sect. 34, T8N, R52W, 1028N, 1553W	Alluvium	75	Municipal
S34	--	NE, NW, Sect. 34, T8N, R52W, 1029N, 1553W	Alluvium	--	Industrial, Municipal
S34	220875	NW, NW, Sect. 34, T8N, R52W, 412N, 4078E	Alluvium	35	Monitoring
S34	220876	NW, NW, Sect. 34, T8N, R52W, 344N, 4107E	Alluvium	33	Monitoring
S34	220874	NW, NW, Sect. 34, T8N, R52W, 356N, 4066E	Alluvium	35	Monitoring
S34	220873	NW, NW, Sect. 34, T8N, R52W, 380N, 3986E	Alluvium	35	Monitoring
S34	39771-MH	NW, NW, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	54319-F	NW, NW, Sect. 34, T8N, R52W, 725N, 750W	Alluvium	--	Irrigation
S34	54320-F	NW, NW, Sect. 34, T8N, R52W, 375N, 900W	Alluvium	--	Irrigation
S34	5504-F	NW, NW, Sect. 34, T8N, R52W	Alluvium	62	Irrigation
S34	38154-MH	NW, NW, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	39772-MH	SW, NW, Sect. 34, T8N, R52W	Alluvium	--	Monitoring
S34	46827-F	SW, NW, Sect. 34, T8N, R52W	Alluvium	--	Gravel Pit
S34	47581-F	SW, NW, Sect. 34, T8N, R52W	Alluvium	--	Gravel Pit
S35	44040	NW, NW, Sect. 35, T8N, R52W,600N, 600W	Alluvium	85	Domestic
S35	45929	NW, NW, Sect. 35, T8N, R52W	Alluvium	78	Domestic
S35	20539-F	NW, NW, Sect. 35, T8N, R52W,650N, 1300W	Alluvium	130	Commercial, Augmentation
S35	20540-F	NW, NW, Sect. 35, T8N, R52W,650N, 1290W	Alluvium	130	Commercial
S35	20539-F	NW, NW, Sect. 35, T8N, R52W,650N, 1230W	Alluvium	122	Commercial, Augmentation
S35	20540-F	NW, NW, Sect. 35, T8N, R52W,1250N, 1150W	Alluvium	660	Commercial, Augmentation
S35	20540-F	NW, NW, Sect. 35, T8N, R52W,650N, 1280W	Alluvium	132	Commercial
S35	17248-F	NW, NW, Sect. 35, T8N, R52W,650N, 1300W	Alluvium	130	Commercial
S35	16968-F	NW, NW, Sect. 35, T8N, R52W	Alluvium	--	Commercial
S35	271198	NW, NW, Sect. 35, T8N, R52W,1250N, 1150W	Alluvium	660	Monitoring

Section	Permit Number	Location	Aquifer	Well Depth (ft)	Use
S35	105538	NW, SW, Sect. 35, T8N, R52W,1400S, 800W	Alluvium	300	Commercial
S35	45929	SW, NW, Sect. 35, T8N, R52W,1330N, 140W	Alluvium	91	Domestic
S35	96388-VE	SW, NW, Sect. 35, T8N, R52W,1330N, 140W	Alluvium	--	Domestic

OIL AND GAS WELLS

The locations for the Class I Injection wells, and all known oil and gas wells within the Area of Review (AOR) are shown in the map below. The Injection wells are shown by markers 1 and 2, the oil and gas wells are shown as markers with letters A through L. The oil and gas wells existing within the AOR range in depth between 4430 ft and 4509 ft. below ground level. None of these wells penetrates the primary confining zone, therefore these oil and gas wells are not expected to act as conduits for injected fluids to contaminate USDWs.

Oil and Gas Wells in the Area of Review



The following table lists the existing oil and gas wells in the AOR and shows the well name, location, well type, and total depth, status, and the letter code that can be used to locate the well on the map, above.

Nearby Oil and Gas Wells						
API No.	Map Code	Location	TD (ft.)	Formation	Well Type	Status
507508986	A	S23, 8N, 52W, 1980 FNL, 1980 FWL	4,449	J Sands	Oil	P&A
507508030	B	S24, 8N, 52W, 1980 FSL, 660 FWL	4,610	J Sands	Oil	P&A
507508223	C	S27, 8N, 52W, 220 FSL, 1790 FWL	4,475	J Sands	Oil/Gas	P&A
507508206	D	S27, 8N, 52W, 1980 FNL, 1980 FEL	4,430	J Sands	Gas	P&A
507508105	E	S27, 8N, 52W, 2010 FNL, 1980 FWL	4,440	J Sands	Oil/Gas	P&A
507508185	F	S27, 8N, 52W, 220 FSL, 850 FWL	4,485	J Sands	Oil	P&A
507508210	G	S33, 8N, 52W, 1780 FSL, 470 FEL	4,476	J Sands	Oil/Gas	P&A
507505602	H	S33, 8N, 52W, 660 FNL, 660 FEL	4,509	J Sands	Gas	P&A
507508087	I	S34, 8N, 52W, 790 FNL, 705 FWL	4,483	J Sands	Oil	P&A
507508182	J	S34, 8N, 52W, 2010 FSL, 630 FWL	4,452	J Sands	Oil	P&A
507508145	K	S34, 8N, 52W, 1820 FNL, 1020 FWL	4,479	J Sands	Oil	P&A
507508146	L	S34, 8N, 52W, 665 FNL, 1980 FWL	4,480	J Sands	Gas	P&A

None of these deeper oil and gas wells penetrates the Skull Creek Shale formation (the primary confining zone), making it unlikely that these wells could act as a conduit for injected fluid to contaminate USDWs. As the injection wells demonstrate adequate casing and cement through the Skull Creek Shale formation, these AOR wells should pose no threat to USDW contamination as a result of the injection activities from the Sterling wells.

Corrective Action Plan

For wells in the AOR that are improperly sealed, completed, or abandoned, the applicant shall develop a Corrective Action Plan (CAP) consisting of the steps or modifications that are necessary to prevent movement of fluid into USDWs.

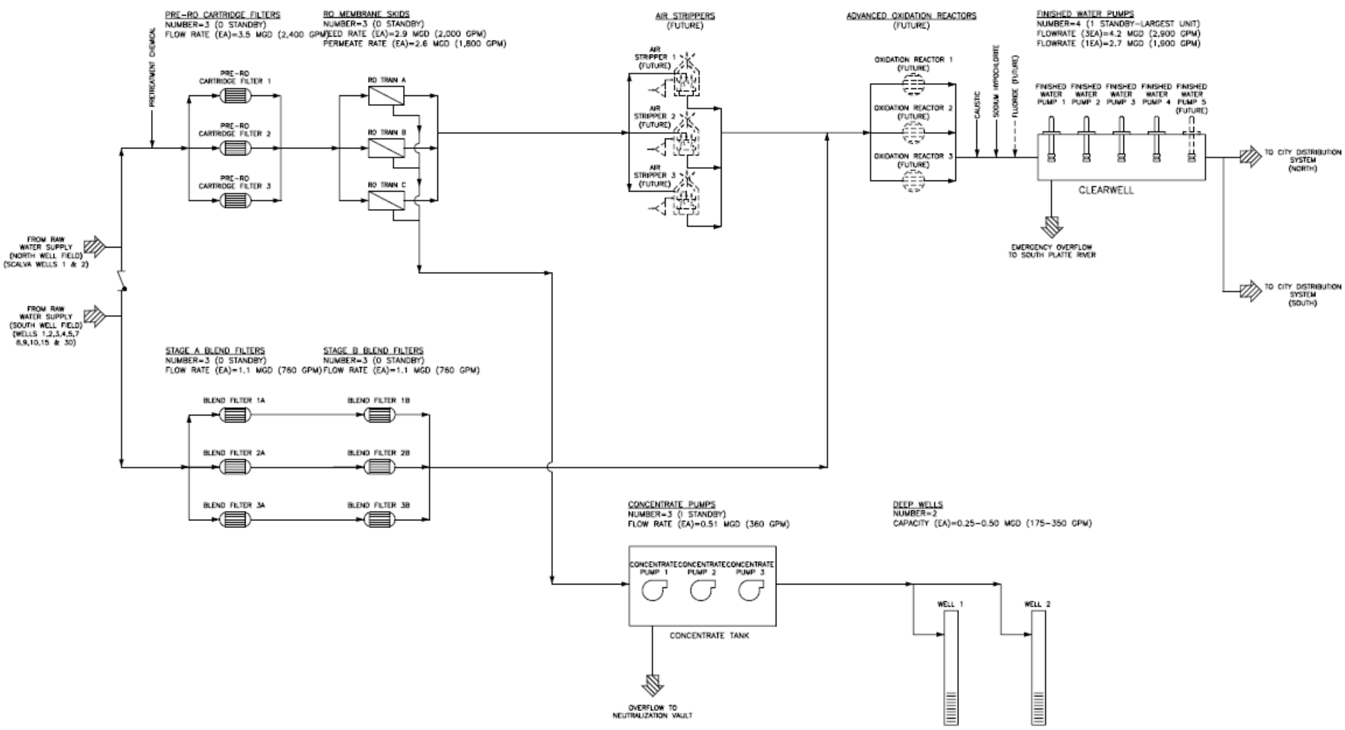
There are no wells within the AOR which penetrate the primary confining zone (Morrison), therefore no corrective action will be required by the permit.

PART V. Well Operation Requirements (40 CFR 146.23)

Approved Injection Fluid

Injection fluid is limited to the concentrated brine generated from the reverse osmosis treatment of raw well water from the city's water treatment plant located near the site of the Sterling Deep Injection Well #1. This fluid may be injected into the deep disposal wells only after sample analysis proves that it meets EPA standards for non-hazardous municipal disposal.

This treatment plant will receive raw water from the City's water production wells and removes contaminants through a reverse osmosis (RO) process. Approximately 80-90% of the raw water emerges from the RO units as product water for distribution to city residents. The remaining 10-20% of the water from the RO units emerges as concentrated brine that will be disposed deep underground via Sterling's Deep Disposal Wells No. 1 and No. 2. This waste water is required to meet EPA standards for non-hazardous municipal fluids prior to disposal. See the water treatment process, below:



In addition to the concentrated brines from the RO units, additional waste fluids may be generated as a result of periodic cleaning of the RO units. As salts concentrate on the high pressure side of the membrane, the very small pores of the membrane may become plugged. Organic compounds can also plug the pores. As a result of this plugging, the flow decreases and the membrane must be cleaned. To maintain efficiency of the RO units, a volume of water is circulated on the high pressure side of the system with a cleaning agent (for hardness or organic plugging) until the membrane is flushed clean.

Prior to introducing this flush fluid to the RO units, it is expected to fall within a pH range of 2.5 to 12. After it is removed from the RO units, this flush fluid will be neutralized prior to disposal.

As part of the permit application, the applicant has submitted the projected water quality information for the concentrated brine intended for injection. This analysis information is shown in the following table:

Projected Water Quality (90% Nanofiltration Recovery)

Parameter	Units	Raw Value [1]	Concentrate Value [2]	Concentration Factor	Percent Removal [3]	Permeate Value
Alkalinity	(mg/L as CaCO3)	247	2,267	9	91%	22
Aluminum	(µg/L)	undetected	undetected	-	-	undetected
Ammonium	(mg/L)	undetected	undetected	-	-	undetected
Antimony	(µg/L)	undetected	undetected	-	-	undetected
Arsenic	(µg/L)	5	50	10	100%	0
Barium	(µg/L)	60	600	10	100%	0
Beryllium	(µg/L)	undetected	undetected	-	-	undetected
Bicarbonate	(mg/L)	301	2,766	9		27
Boron	(mg/L)	0.291	2.91	10	100%	0
Bromide	(µg/L)	624	4,331	7	66%	212
Cadmium	(µg/L)	undetected	undetected	-	-	undetected
Calcium	(mg/L)	191	1,807	9	94%	11
Chloride	(mg/L)	97	752	8	75%	24
Chromium	(µg/L)	undetected	undetected	-	-	undetected
Copper	(µg/L)	undetected	42	-	-	undetected
Fluoride	(mg/L)	0.89	8.9	10	100%	0
Hardness	(mg/L as CaCO3)	719	6,827	9	94%	41
Iron Dissolved	(µg/L)	undetected	418	-	-	undetected
Lead	(µg/L)	2.3	9.3	4.1	34%	1.5
Manganese	(µg/L)	462	4,620	10	100%	0
Magnesium	(mg/L)	59	563	10	95%	3.0
Mercury	(µg/L)	undetected	undetected	-	-	undetected
Nickel	(µg/L)	undetected	26	-	-	undetected
Nitrate as N	(mg/L)	4.06	13.6	3	26%	3.00
Nitrite as N	(mg/L)	undetected	undetected	-	-	undetected
Ortho-P as P	(mg/L)	undetected	1	-	-	undetected
pH	(SU)	7.4	7.7	-	-	6.8
Potassium	(mg/L)	16	133	8	81%	3.0
Selenium	(µg/L)	4.0	40	10	100%	0
Silver	(µg/L)	undetected	undetected	-	-	undetected
Sodium	(mg/L)	182	1,509	8	81%	34.6
Strontium	(mg/L)	1.5	15	10	100%	0
Sulfate	(mg/L)	755	7,210	10	95%	37.8
Sulfide	(mg/L)	undetected	undetected	-	-	undetected
Silica	(mg/L)	28	247	9	87%	3.6
Thallium	(µg/L)	undetected	undetected	-	-	undetected
TDS	(mg/L)	1,632	14,704	9	89%	180
TOC	(mg/L)	3.1	31	10	100%	0
Total Iron	(µg/L)	1,094	10,940	10	100%	0
TP as P	(mg/L)	undetected	1	-	-	undetected
Uranium [4]	(µg/L)	40	382	10	95%	2.0
Gross Alpha [5], [6]	(pCi/L)	29	277	10	95%	1.5
Gross Beta [6]	(pCi/L)	18	172	10	95%	0.9
Radium 226 [6]	(pCi/L)	0.4	4	10	95%	0.02
Radium 228 [6]	(pCi/L)	0.5	5	10	95%	0.03

(1) Raw values based on blended raw water quality during peak demands (40% Site 1 Wells and 60% Scalva Wells).

(2) Concentrate values based on 90% recovery nanofiltration system.

(3) Percent removal values based on pilot testing. Percent removal for gross alpha, gross beta, radium 226 and radium 228 estimated to be similar to removal of uranium.

(4) 550 µg/L of naturally occurring uranium = 372 pCi/L

(5) Gross alpha includes total alpha particle activity. Raw value based on average from 2004 - 2008.

(6) Raw values for gross alpha, gross beta, radium 226 and radium 228 based on average from 2004 - 2008 sampling.

This projected water quality information shows the fluid to be non-hazardous; however, the uranium levels are higher than levels that would allow the fluid to be injected above the lowermost USDW. For this reason, injection will only be approved into a geologic formation that exists below the base of all USDWs.

These Class I injection wells are NOT approved for disposal or injection of hazardous waste as defined by CFR 40 Part 261.

Injection Pressure Limitation (40 CFR 146.13(a)(1))
Injection pressure, measured at the wellhead, shall not exceed a maximum calculated to assure that the pressure used during injection does not initiate new fractures or propagate existing fractures in the injection zone. During well completion, Step Rate tests (SRT) were conducted on each well to help identify fracture gradients. On the Sterling No. 1 well, each of the injection formations were tested separately through a workstring immediately after perforating. On the Sterling No. 2 well, a SRT was conducted on all injection formations simultaneously through the permanent injection tubing set on a packer. During this test, the Sterling No. 2 achieved a maximum surface pressure of 2302 psi using a fluid with a specific gravity of 1.02. This resulted in a measured bottom hole pressure of 2947 psi. During normal operation for the Sterling No. 2 well, is expected to inject fluids with no more than 1.04 specific gravity (SG). With a 1.04 SG fluid, the corresponding surface pressure for the Sterling No. 2 well is 2245 psi. MAIP for the Sterling No. 2 will be rounded down to 2200 psi as measured at the wellhead.

A review of the results of the Step Rate Tests conducted on the individual intervals in the Sterling No. 1 well indicates that the bottom hole pressures will remain below fracture pressure with the application of 2200 psi at the surface.

Maximum Allowable Injection Pressure (MAIP), as measured at the surface		
Well	Injected Fluid Specific Gravity	Initial MAIP (psi)
Sterling No. 1	< 1.04	2200
Sterling No. 2	< 1.04	2200

Injection Volume Limitation
There is no limitation on the number of barrels of fluid that shall be injected into this well, provided further that in no case shall injection pressure exceed the MAIP.

Mechanical Integrity (40 CFR 146.8 and GW Section Guidance #39)
An injection well has mechanical integrity if:

1. There is no significant leak in the casing, tubing, or packer (Part I); and
2. There is no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore (Part II).

The Permit prohibits injection into a well which lacks mechanical integrity.

The Permit requires that the well demonstrate mechanical integrity prior to injection and periodically thereafter.   A demonstration of mechanical integrity includes both internal (Part I) and external (Part II). The methods and frequency for demonstrating Part I and Part II mechanical integrity are dependent upon well-specific conditions as explained below.

Well construction and site-specific conditions dictate the following requirements for Mechanical Integrity (MI) demonstrations:

Part I MI - Internal MI will be demonstrated prior to beginning injection. Since these wells are constructed with a standard casing, tubing, and packer configuration, a successful test is required by UIC GW Section Guidance 39 to take place at least once every five (5) years. A demonstration of Part I MI is also required prior to resuming injection following any workover operation that affects the casing, tubing, or packer.

Part II MI - External MI will be demonstrated prior to beginning injection operations Class I injection well regulations require the use of a Temperature Log. Cement Bond or Cement Evaluation type logs will also be used to assess the quality and location of the cement. If the cement logs do not meet minimum requirements for cement quality and quantity, Part II MI will be evaluated with periodic Radioactive Tracer Surveys.

Sterling No. 2 well has successfully demonstrated Part I MI through a pressure test. Sterling No. 1 well will be required to pass Part I MI prior to receiving authorization to begin injection. Both wells have successfully demonstrated adequate annular cement bond to casing by meeting Cement Bond requirements.

PART VI. Monitoring, Recordkeeping and Reporting Requirements

MONITORING:

Instantaneous injection and annulus pressures, injection rate, and cumulative injected volume must be observed and recorded continuously once Authorization to Inject has been granted and the wells begin normal injection operations.

FLUID ANAYLSIS:

Once monthly, the Permittee must analyze a sample of the injected fluid according to the list of analytes shown below. After the monthly analyses show that the injection fluid has stabilized, sampling will be made on a quarterly basis, the results of which will be submitted to EPA as part of the Quarterly Report to the Director according to the schedule shown in the section titled “REPORTING”, below.

Parameter Analyzed	EPA Analytical Method
Total Dissolved Solids (mg/l)	
Total Suspended Solids (mg/l)	
Specific Conductivity (umhos/cm)	
pH	
Specific Gravity	
Corrosivity Index (Langelier Saturation Index)	
Nitrate-Nitrite (both as N) mg/l	
Sulfate (mg/l)	
Chloride (mg/l)	
Magnesium (mg/l)	
Sodium (mg/l)	
Calcium (mg/l)	
Iron (mg/l)	
Gross Alpha (pCi/l)	E900.0
Gross Beta (pCi/l)	E900.0
Strontium (mg/l)	272.1, 272.2, 200.7
Uranium-234 (pCi/l)	E907.0
Uranium-238 (pCi/l)	E907.0
Thorium-230 (pCi/l)	E907.0
Radium-226 (pCi/l)	E903.0
Radium-228 (pCi/l)	E904.0
Potassium-40 (pCi/l)	E901.1
Lead-210 (pCi/l)	E905.0 Mod.

REPORTING:

After injection operations begin, monthly averages and monthly maximum and minimum values shall be tabulated for injection and annulus pressures, injection rate, and cumulative injected volume. This information is required to be reported quarterly, along with a listing of the sources of injected fluids, as part of the Quarterly Report to the Director.

SCHEDULE FOR QUARTERLY REPORTING:

	REPORTING PERIOD	REPORT DUE TO EPA
1st Quarter	January 1 – March 31	May 15
2nd Quarter	April 1 – June 30	August 15
3rd Quarter	July 1 – September 30	November 15
4th Quarter	October 1- December 31	February 15

PART VII. Plugging and Abandonment Requirements (40 CFR 146.10)

Plugging and Abandonment Plan

The plugging and abandonment plan for this project has been designed to prevent the movement of fluids into or between USDWs. Cement plugs will be placed as follows to accomplish that goal:

- In order to isolate the injection zone, all injection perforations will be squeezed with cement, and a cement plug will be placed inside casing to a point 100 ft above the uppermost perforation.

- The lowermost USDW will be isolated from deeper non-USDWs by placing a bridge plug 50 ft below the base of USDWs and by setting a 100 ft cement plug on top of the bridge plug.

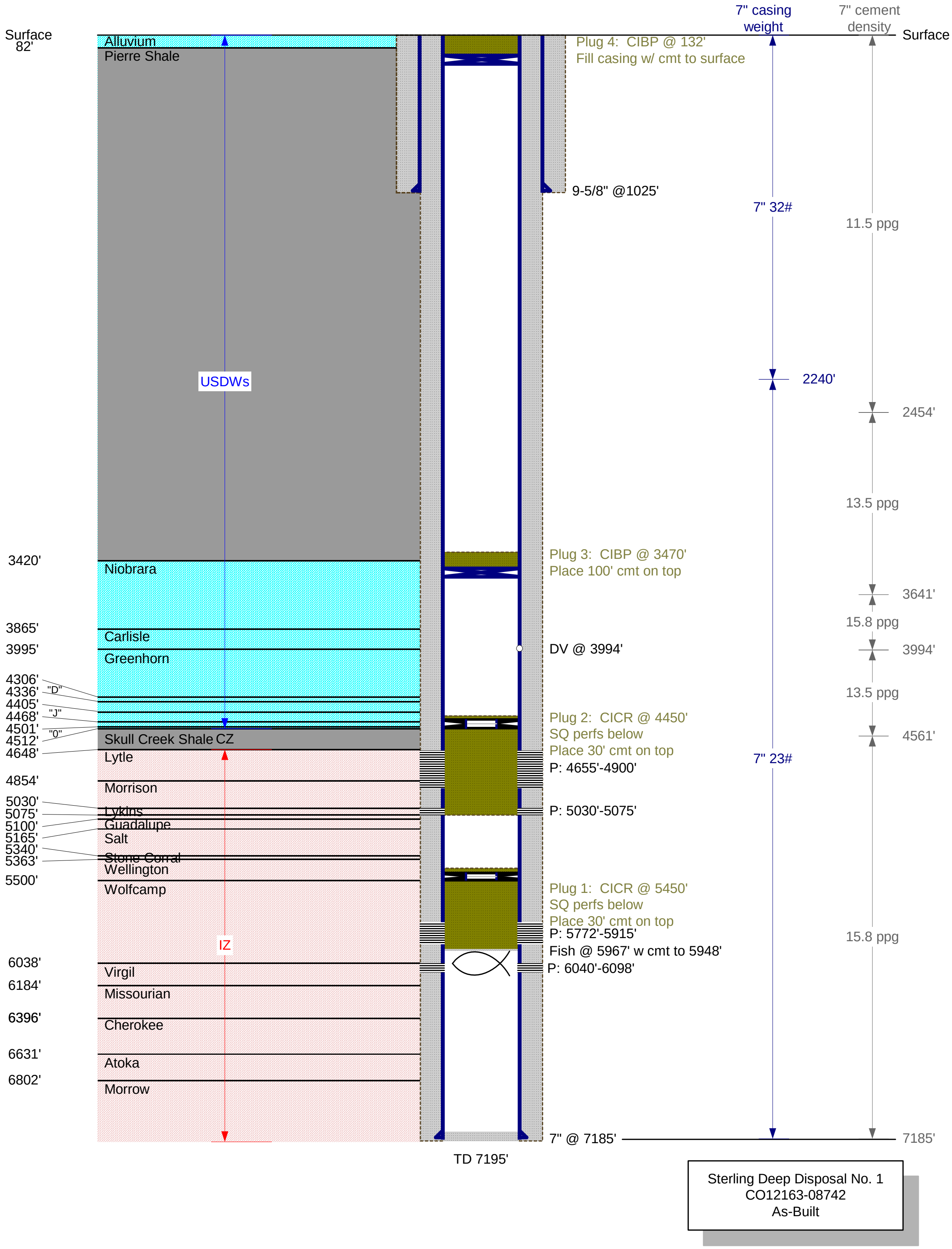
- The deeper USDWs will be isolated from the Alluvial aquifers by placing a bridge plug 50 ft below the top of the Niobrara Formation and by placing a 100 ft cement plug on top of the bridge plug.

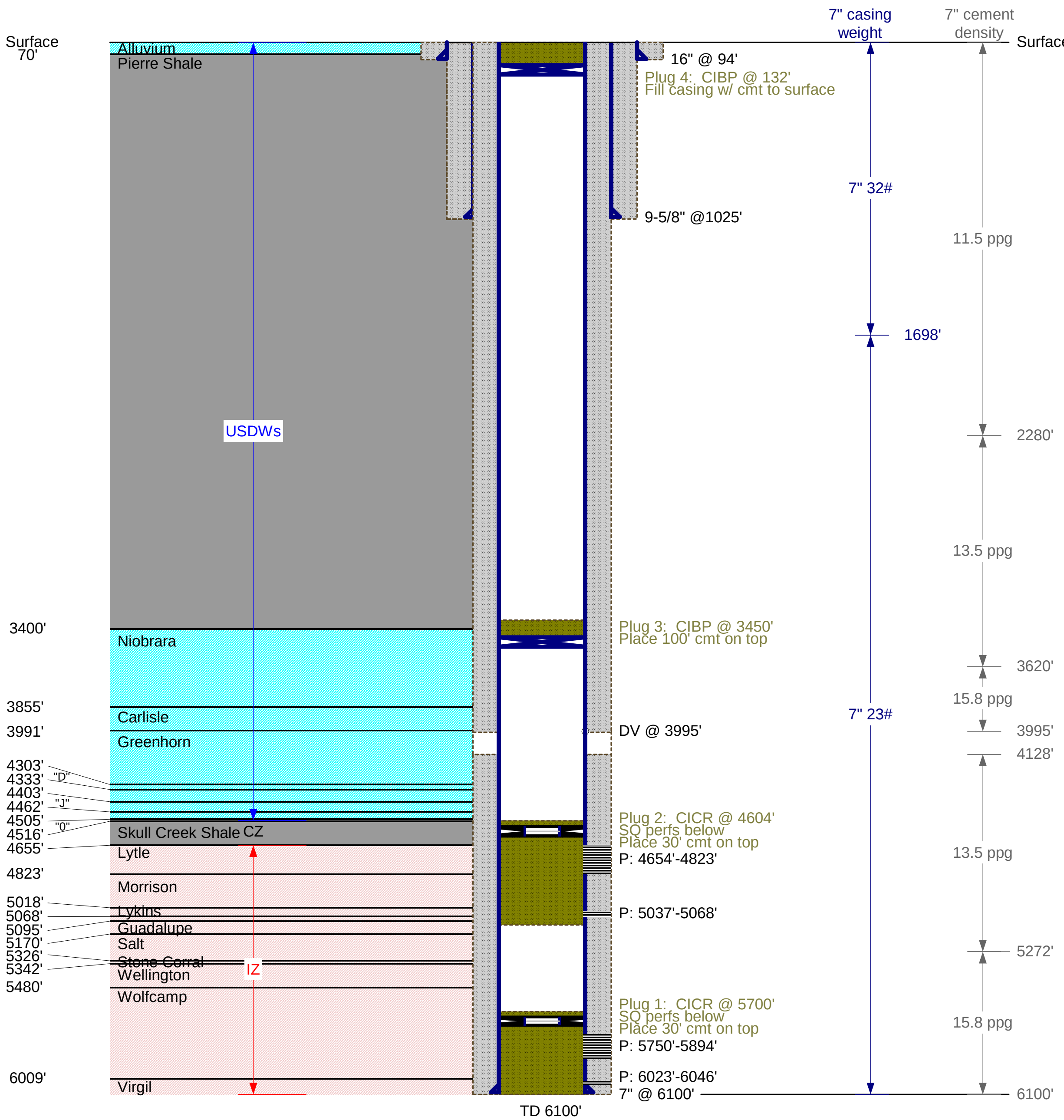
- The base of the surface casing will be isolated by placing a bridge plug 50 ft below the base of surface casing by setting a 100 ft cement plug on top of the bridge plug.

- The Alluvial aquifers will be protected by placing a bridge plug 100 ft below the base of the Alluvial aquifers and by filling the casing with cement plug from the bridge plug to surface.

- Intervals not plugged with cement will be filled with 9.6 ppg mud or plugging gel.

The plugging plan can be seen in the schematic diagram on the following page.


7" casing weight
7" cement density
Surface
82'
Surface
Alluvium
Pierre Shale
Plug 4: CIBP @ 132'
Fill casing w/ cmt to surface
9-5/8" @1025'
7" 32#
11.5 ppg
USDWs
2240'
2454'
13.5 ppg
3420'
Niobrara
Plug 3: CIBP @ 3470'
Place 100' cmt on top
3641'
3865'
Carlisle
15.8 ppg
3995'
Greenhorn
DV @ 3994'
3994'
4306'
4336' "D"
4405'
4468' "J"
4501' "O"
4512'
4648'
13.5 ppg
Plug 2: CICR @ 4450'
SQ perfs below
Place 30' cmt on top
P: 4655'-4900'
4561'
Skull Creek Shale CZ
Lytle
7" 23#
4854'
Morrison
5030'
5075'
5100'
5165'
5340'
5363'
Lykins
Guadalupe
Salt
Stone Corral
Wellington
P: 5030'-5075'
5500'
Wolfcamp
Plug 1: CICR @ 5450'
SQ perfs below
Place 30' cmt on top
P: 5772'-5915'
Fish @ 5967' w cmt to 5948'
P: 6040'-6098'
15.8 ppg
IZ
6038'
Virgil
6184'
Missourian
6396'
Cherokee
6631'
Atoka
6802'
Morrow
7" @ 7185'
7185'
TD 7195'
Sterling Deep Disposal No. 1
CO12163-08742
As-Built



Sterling Deep Disposal No. 2
CO12163-08743
As-Built

PART VIII. Financial Responsibility (40 CFR 144.52)

Demonstration of Financial Responsibility

The Permittee is required to maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in a manner prescribed by the Director. The Permittee shall show evidence of such financial responsibility to the Director by the submission of a surety bond, or other adequate assurance such as financial statements or other materials acceptable to the Director. The Regional Administrator may, on a periodic basis, require the Permittee to submit a revised estimate of the resources needed to plug and abandon the well to reflect inflation of such costs, and a revised demonstration of financial responsibility if necessary. Initially, the operator has chosen to demonstrate financial responsibility with:

A Letter of Credit with a Standby Trust Fund.

Evidence of continuing financial responsibility is required to be submitted to the Director annually.