



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8**

1595 Wynkoop Street
Denver, CO 80202-1129
Phone 800-227-8917
<http://www.epa.gov/region8>

Ref: 8WD-SDU

**SENT VIA EMAIL
DIGITAL READ RECEIPT REQUESTED**

Mr. Mark Harding, President
Rangeview Metropolitan District
mharding@purecyclewater.com

Re: Issuance of Draft Permit - CO52414-00000, Rangeview Metropolitan District, Class V Area Permit, Wells A-1, A-5 and A-13

Dear Mr. Harding:

Enclosed is a copy of the U.S. Environmental Protection Agency Region 8 Underground Injection Control (UIC) draft permit (Permit) for the above-referenced project area. Also enclosed are copies of the statement of basis for the proposed action and the public notice posted on EPA's website at <https://www.epa.gov/uic/underground-injection-control-epa-region-8-co-mt-nd-sd-ut-and-wy>.

EPA regulations and procedures for issuing UIC permit decisions are found in Title 40 of the Code of Federal Regulations (40 CFR) part 124. These regulations and procedures require a public notice and the opportunity for the public to comment on this proposed permit decision. The public comment period will run for at least 30 days and a courtesy announcement of the comment period, also enclosed, has been published in the following newspaper:

Sentinel Colorado

A final decision will not be made until after the close of the comment period announced on EPA's website. All relevant comments will be taken into consideration. If any substantial comments are received, the effective date of the final Permit will be delayed for an additional 30 days, as required by 40 CFR § 124.15(b), to allow for any potential appeal of the final Permit decision.

If you have any questions or comments about the above action, please contact Lise Marie Bisson at (303) 312-6266 or Bisson.LiseMarie@epa.gov.

Sincerely,

12/15/2020

 Sarah Bahrman

Signed by: SARAH BAHRMAN

Sarah Bahrman, Chief
Safe Drinking Water Branch
Water Division

Enclosures

cc:

Courtney Hemenway
chemenway1@msn.com

Scott Lehman
slehman@purecyclewater.com

Tyson Ingels, Lead Drinking Water Engineer
tyson.ingels@state.co.us

Randy Ogg, Groundwater Permitting Coordinator
randy.ogg@state.co.us

Colorado State Engineers Office
Kevin Rein, State Engineer
Kevin.rein@state.co.us

STATEMENT OF BASIS

Rangeview Metropolitan District Arapahoe County, Colorado

Class V Aquifer Storage and Recovery Area Permit
CO52414-00000

CONTACT: Lise Marie Bisson, P.G.
U. S. Environmental Protection Agency
Underground Injection Control Program (UIC), 8WD-SDU
1595 Wynkoop Street
Denver, Colorado 80202-1129
Telephone: (303) 312-6266
Email: bisson.lisemarie@epa.gov

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 CO52414-00000 (Permit).

The United States Environmental Protection Agency Underground Injection Control (UIC) Program permits regulate the injection of fluids into underground injection wells so that the injection does not endanger underground sources of drinking water (USDWs). EPA UIC permit conditions are based upon the authorities set forth in regulatory provisions at 40 CFR parts 2, 124, 144, 146 and 147, and address potential impacts to USDWs. In accordance with 40 CFR § 144.35, issuance of this Permit does not convey any property rights of any sort or any exclusive privilege, nor authorize injury to persons or property or invasion of other private rights, or any infringement of other federal, state or local laws or regulations. 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 the 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 when issued, the Permit authorizes the construction and operation of injection wells so that the injection does not endanger USDWs. The Permit is issued for the a period of three years unless terminated for reasonable cause under 40 CFR § 144.40 and can be modified or revoked and reissued under 40 CFR § 144.39 or § 144.41. The Permit is subject to EPA's review at least once every three (3) years to determine if action is required under 40 CFR § 144.36(a).

The Permit will expire upon delegation of primary enforcement responsibility (primacy) for applicable portions of the UIC Program to an approved state or tribal program, unless the delegated agency has the authority and chooses to adopt and enforce this Permit as a tribal or state permit.

The Rangeview Metropolitan District (RMD) is the “Permittee”. RMD is a Title 32 quasi municipal, political subdivision of the State of Colorado. It was organized in 1986 to develop water resources, water systems and facilities, wastewater collection and treatment facilities for customers in its service area. The RMD service area covers approximately 24,000 acres (40 square miles) of the Lowry Range in southeastern Arapahoe County. In order to ensure the Permittee continues to provide sustainable water, the Permittee has submitted an application to utilize an aquifer storage and recovery system (ASR). This system will allow the Permittee to store treated water in the subsurface during periods of low demand and then recover the water to supply their customers during periods of high demand.

PART I. General Information and Description of Project

Rangeview Metropolitan District
 34051 East Quincy Avenue
 Building 34, Box 10
 Watkins, Colorado 80137

submitted an application for a UIC Class V permit for the following area:

Table 1
RANGEVIEW SERVICE AREA COORDINATES

Township 7 S, Range 64 W, Section 7	Township 7 S, Range 64 W, Section 34
Township 7 S, Range 64 W, Section 8	Township 4 S, Range 65 W, Section 33
Township 7 S, Range 64 W, Section 9	Township 4 S, Range 65 W, Section 34
Township 7 S, Range 64 W, Section 10	Township 5 S, Range 64 W, Section 11 NW1/4 of SW 1/4
Township 7 S, Range 64 W, Section 15	Township 5 S, Range 65 W, Section 3
Township 7 S, Range 64 W, Section 16	Township 5 S, Range 65 W, Section 10
Township 7 S, Range 64 W, Section 17	Township 5 S, Range 65 W, Section 11
Township 7 S, Range 64 W, Section 18	Township 5 S, Range 65 W, Section 12
Township 7 S, Range 64 W, Section 19	Township 5 S, Range 65 W, Section 13
Township 7 S, Range 64 W, Section 20	Township 5 S, Range 65 W, Section 14
Township 7 S, Range 64 W, Section 21	Township 5 S, Range 65 W, Section 15
Township 7 S, Range 64 W, Section 22	Township 5 S, Range 65 W, Section 22
Township 7 S, Range 64 W, Section 27	Township 5 S, Range 65 W, Section 23
Township 7 S, Range 64 W, Section 28	Township 5 S, Range 65 W, Section 24
Township 7 S, Range 64 W, Section 29	Township 5 S, Range 65 W, Section 25
Township 7 S, Range 64 W, Section 30	Township 5 S, Range 65 W, Section 26
Township 7 S, Range 64 W, Section 31	Township 5 S, Range 65 W, Section 27
Township 7 S, Range 64 W, Section 32	Township 5 S, Range 65 W, Section 35

Township 7 S, Range 64 W, Section 33	Township 5 S, Range 65 W, Section 36
Township 5 S, Range 65 W, Section 34	
N 1/2 of N 1/2 and northernmost 104.63 acres of S1/2 and N1/2	

A parcel of land situated in Sections 15 and 22 of Township 5 S, Range 65 W, totaling approximately 445.99 acres, is not included. The legal description of this parcel of land is on file with EPA.

The Permittee requests to inject potable drinking water, store it, and recover the water from the Arapahoe Aquifer. Injection water will be supplied from RMD's drinking water distribution system. Sources of treated drinking water to be injected are from the Dawson, Denver, Arapahoe and Laramie Fox-Hills Aquifers. The injectate will be treated to drinking water standards at various water treatment plants (WTPs) operated by Aurora Water and other Water, Infrastructure, Supply and Efficiency (WISE) partners.

The application, including the required information and data necessary to issue or modify a UIC permit in accordance with 40 CFR parts 2, 124, 144, 146 and 147, was reviewed and determined by EPA to be complete.

PART II. Permit Considerations (40 CFR § 146.24)

Hydrogeologic Setting

RMD is one of several water districts which operate in the Denver Basin. The Denver Basin, variously referred to as the Julesburg Basin, Denver-Julesburg Basin (after Julesburg, Colorado), or the D-J Basin, is a geologic structural basin centered in eastern Colorado in the United States, but extending into southeast Wyoming, western Nebraska, and western Kansas. It underlies the Denver-Aurora Metropolitan Area on the eastern side of the Rocky Mountains.

The basin consists of a large asymmetric syncline of Paleozoic, Mesozoic, and Cenozoic sedimentary rock layers, trending north to south along the east side of the Front Range from the vicinity of Pueblo northward into Wyoming. The basin is deepest near Denver, where it reaches a depth of approximately 13,000 feet (ft) (3900 meters (m)) below the surface. The basin is strongly asymmetric: the Dakota Sandstone outcrops in a "hog-back" ridge near Morrison a few miles west of Denver, reaches its maximum depth beneath Denver, then ascends very gradually to its eastern outcrop in central Kansas. The Dakota hogback exposes Dakota Sandstone overlying and protecting the Morrison Formation beneath and to the west. Between Golden and Morrison, the Dakota hogback is called Dinosaur Ridge and is the site of a dinosaur trackway and dinosaur fossils exposed in the outcrop that are part of a Colorado State Natural Area and Geological Points of Interest. The Lyons and Lykins formations outcrop in a smaller hogback. Farther west, the Fountain Formation outcrops as flatirons and forms the namesake of the Red Rocks Park and Amphitheatre. Against the eastern edge of the Rocky Mountain Front range, the Fountain Formation is in nonconformable contact with the Precambrian crystalline rock of the Idaho Springs Formation.

The basin started forming as early as 300 million years ago, during the Colorado orogeny that created the Ancestral Rockies. Rocks formed during this time include the Fountain Formation, which is most prominently visible at Red Rocks, and the Boulder Flatirons. The present basin was within the Cretaceous Interior Seaway, which deposited a thick Cretaceous section in the basin.

The basin was most likely further deepened in Paleogene time, between 66 and 45 million years ago, during the Laramie orogeny that created the modern Colorado Rockies. In particular, the uplifting of the Rockies in the Front Range caused the crust near Denver to buckle downward on the eastern side, deepening the basin. The basin later became filled with sediment eroded from the Rockies. The Front Range peaks rise approximately 22,000 feet (ft.) (6600 m) from the floor of the basin under Denver.

The deep part of the basin near Denver became filled with Paleogene sandstone and conglomerate, a layer now called the Denver Formation. In the regions to the north and south of Denver, however, stream erosion removed the Paleogene layers, revealing the underlying Cretaceous Pierre Shale.

The upper formations of the Denver Basin are aquifers that serve as important sources of water supply in the region. The Denver Basin includes four aquifers of major significance. In ascending order, these are: Laramie-Fox Hills Aquifer; Arapahoe Aquifer; Denver Aquifer; and Dawson Aquifer.

The receiving formation will be the Arapahoe Aquifer, a sequence of interbedded sandstones, siltstones, and shales ranging from approximately 495 feet thick (in A-1) to 745 feet thick (in A-13) at the injection sites. This aquifer underlies large portions of the Denver Basin. It is used both by RMD and numerous other entities for drinking water throughout the basin.

The structures through which water will be injected and recovered are:

- Well A-1, Division of Water Resources (DWR) Permit 47701-F, EPA Permit CO52414-11964 - In this location, the Arapahoe Aquifer exists between 1005 and 1750 feet below ground surface (bgs) (per Colorado State Engineer's Office (SEO) determination in permit), and is categorized by the Denver Basin Rules and Regulations (2 CCR 402-6) as non-tributary.
- Well A-5, DWR Permit 54367-F, EPA Permit CO52414-11965 - In this location, the Arapahoe Aquifer exists between 1065 and 1550 feet bgs (per SEO determination in permit), and is categorized by the Denver Basin Rules and Regulations (2 CCR 402-6) as non-tributary.
- Well A-13, DWR Permit 63493-F, EPA Permit CO52414-12008 - In this location, the Arapahoe Aquifer exists between 995-1510 feet bgs (per SEO determination in permit), and is categorized by the Denver Basin Rules and Regulations (2 CCR 402-6) as non-tributary.

Geologic logs for the three proposed injection wells are presented below, and are based on data obtained from cutting samples, geograph readings, and geophysical logs. Depths are approximate values. The formation tops and bottoms are subject to interpretation. The SEO provides a Denver Basin modeling tool which estimates the depth of the Denver Basin Aquifers. The SEO picks tops and bottoms for each aquifer, but the bottom of one aquifer is not the top of

the underlying aquifer. Instead, the SEO has tried to define confining beds which lie between the aquifers and interprets the bottom of an aquifer as the top of the underlying clay/shale confining bed, and the top of the next deep aquifer as the bottom of the overlying clay/shale bed.

For the purposes of the geologic settings of each proposed well presented below, formation tops and bottoms presented in the DWR permit documents for each well were used.

**Table 2.1A
Well A-1 Geologic Setting**

Formation Name	Top (ft)*	Base (ft)*	Lithology
Lower Dawson ~133 ⁽¹⁾	0	356	Shale, grey, with rare siltstone, sandy layers.
Base of Lower Dawson ~351 ⁽¹⁾	356	372	Sandstone, brown, fine-medium gr.
Denver ~390 ⁽¹⁾	372	528	Sandstone, brown, fine-medium gr. alternating with shale, grey layers.
	528	540	Sandstone, brown, fine-medium gr.
	540	548	Shale, grey.
	548	552	Coal, black.
	552	636	Shale, grey.
	636	644	Sandstone, grey, fine-medium gr.
	644	656	Shale, grey.
	656	666	Sandstone, grey, fine-medium gr.
Top Arapahoe ~ 1005 ⁽²⁾	666	1366	Shale, grey, with rare coal, black lenses and rare sandstone, grey, very fine-fine gr lenses.
	1366	1464	Sandstone, grey, fine-coarse gr. with occasional shale, grey layers.
	1464	1502	Shale, grey.
	1502	1513	Sandstone, grey, fine-medium gr.
	1513	1567	Shale, grey.
	1567	1576	Sandstone, grey, fine-coarse gr.
	1576	1597	Shale, grey.
	1597	1608	Sandstone, grey, fine-coarse gr.
	1608	1633	Shale, grey.
	1633	1670	Sandstone, grey, fine-coarse gr., with rare shale, grey lenses.

	1670	1733	Shale, grey.
Laramie 1750 ⁽²⁾	1733	1761	Sandstone, grey, fine-medium gr.
	1761	1895	Shale, grey.

(¹) Based on SEO Model in DWR Permit. (²) Based on notes handwritten in DWR Permit.

TABLE 2.1B
Well A-5 Geologic Setting

Formation Name	Top (ft)*	Base (ft)*	Lithology
Dawson	0	143	Siltstone, grey, with some shale, grey layers.
Base of Lower Dawson ~163'	143	165	Sandstone, fine-medium gr., grey.
Denver~199'	165	220	Shale, grey.
	220	420	Sandstone, fine-medium gr., grey alternating with shale, grey layers, and some coal black.
	450	462	Sandstone, fine-medium gr., grey.
	462	517	Shale, grey with coal, black layers.
	517	534	Sandstone, fine-medium gr., grey.
	534	567	Shale, grey.
	567	748	Sandstone, fine-medium gr., grey with occasional shale, grey layers and rare coal, black layers.
	748	785	Sandstone, fine-medium gr., grey.
Base of Denver~988' Arapahoe ~1065'	785	1128	Sandstone, fine-medium gr., grey, alternating with shale, grey.
	1128	1146	Sandstone, silty, fine-medium gr.
	1146	1167	Shale, grey.
	1167	1190	Sandstone, fine-medium gr., grey.
	1190	1288	Sandstone, fine-coarse gr., grey with some shale, grey.
	1288	1370	Shale, sandy, grey.
	1370	1500	Shale, grey, alternating with sandstone, fine-coarse gr., grey.
Base of Arapahoe~1550'	1500	1660	Shale, grey.

Table 2.1C
Well A-13 Geologic Setting

Formation Name	Top (ft)*	Base (ft)*	Lithology
Dawson	0	40	No description available.
	40	50	Shale, grey.
Lower Dawson~51'	50	60	Sandstone, dark grey, fine gr., silty, moderate sorting.
	60	90	Siltstone, grey, muscovite.
Denver ~ 115' ⁽¹⁾	90	190	Shale, grey, siltstone, grey, some coal.
	190	200	Sandstone, grey, fine gr., well sorted, some coal.
	200	220	Coal (lignite), black.
	220	240	Shale, lt. grey.
	240	250	Sandstone, grey, fine-gr. to silty, moderate sorting, muscovite.
	250	340	Shale, grey, siltstone, grey, sandy, muscovite.
	340	380	Coal (lignite), black.
	380	420	Shale, grey.
	420	440	Sandstone, lt. grey, fine gr. to silty, mod. sorting.
	440	450	Siltstone, grey.
	450	460	Coal (lignite), black.
	460	610	Mostly shale, grey to dark grey, interbedded with siltstone, lt. grey to grey.
	610	630	Coal (lignite), black.
	630	760	Shale, grey to dark grey, some siltstone, grey.
	760	950	Sandstone, lt. grey, fine gr., well sorted, some shale and siltstone, grey.
Arapahoe ~ 995' ⁽¹⁾	950	1020	Shale, grey, some siltstone, grey.
	1020	1060	Sandstone, grey, silty to fine grained, mod. sorted.
	1060	1090	Siltstone, grey to olive, some muscovite.
	1090	1110	Siltstone, grey.
	1110	1130	Shale, grey.

Formation Name	Top (ft)*	Base (ft)*	Lithology
	1130	1150	Sandstone, lt. grey, fine gr., well sorted.
	1150	1270	Shale and siltstone, grey.
	1270	1280	Sandstone, lt. grey, fine gr., well sorted.
	1280	1480	Shale, grey, fissile, some siltstone.
Laramie-Fox Hills~1510 ⁽¹⁾	1480	1580	Siltstone, grey to dark grey with depth.

⁽¹⁾Based on information presented on Installation Detail Log.

Injection Zones

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 Table 2.2.

Table 2.2
INJECTION ZONES

Well Name	Formation Name or Stratigraphic Unit	Top (ft)*	Base (ft)*	Exemption Status
A-1 ⁽¹⁾	Arapahoe	1345	1760	N/A
A-5 ⁽²⁾	Arapahoe	1055	1548	N/A
A-13 ⁽³⁾	Arapahoe	996	1498	N/A

⁽¹⁾Based on Form GWS-25 in the DWR permit, the Arapahoe Aquifer “is located at a depth of approximately 1005 feet below land surface and extends to a depth of approximately 1750 feet at the location of A-1”. However, the well screen is placed from approximately 1345 feet bgs to 1760 feet bgs. Therefore, the screened interval represents the injection zone in A-1.

⁽²⁾The well screen is placed from approximately 1055 feet bgs to 1548 feet bgs. Therefore, the screened interval represents the injection zone in A-5.

⁽³⁾Based on the well construction log, the well screen is placed from approximately 996 feet bgs to 1498 feet bgs. Therefore, the screened interval represents the injection zone in A-13.

Confining Zones

A confining zone is a geological formation, part of a formation, or a group of formations that limits fluid movement above and below the injection zone. The confining zones are listed in Tables 2.3A-2.3C.

**Table 2.3A
CONFINING ZONES
Well A-1**

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Confining Zone Denver Formation	666	1005 ⁽¹⁾	Shale, grey, with rare coal, black lenses and rare sandstone, grey, very fine-fine gr. lenses.
Lower Confining Zone Laramie Formation	1761	1895	Shale, grey.

⁽¹⁾ The depth listed is the Top of the Arapahoe Aquifer presented in the DWR permit (Form GWS-25).

**Table 2.3B
CONFINING ZONES
Well A-5**

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Confining Zone Denver Formation	199	988	Shales, sandstones, siltstones and coal.
Lower Confining Zone Base of Arapahoe	1550	1650	Shale, grey.

**Table 2.3C
CONFINING ZONES
Well A-13**

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Confining Zone Denver Formation	115	995	Shales, sandstones, siltstone and coal.
Laramie-Fox Hills Confining Zone	1510	1580 (Total Depth)	Siltstone, grey to dark grey with depth.

The upper and lower confining layers for the proposed injection wells were obtained from Geologic Logs and data found in the SEO's data base. Additional confining layers isolate the

Denver Formation from the Dawson Formation. Confinement and minimal injection pressures are expected to maintain the injectate in the Arapahoe Aquifer injection zone.

Underground Sources of Drinking Water (USDWs)

Aquifers, or the portions thereof, which:

- 1) currently supply any public water system or
- 2) contain a sufficient quantity of groundwater to supply a public water system and currently supply drinking water for human consumption, or
- 3) contain fewer than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS), are considered to be USDWs.

The receiving aquifer, the Arapahoe, is a USDW and currently supplies water for the Denver metropolitan area. Pursuant to the UIC regulations at 40 CFR Part 144.12, underground injection cannot cause movement of a contaminant into a USDW, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142. Whenever the Director learns that a Class V well may be adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any action authorized under paragraph 144.12(c).

Other USDWs exist above and below the proposed injection zones. The proposed injection fluid is treated to drinking water standards at various water treatment plants operated by Aurora Water and WISE. EPA has concluded that the other USDWs at this location will not be impacted by injection activities due to the geologic isolation separating them from the injection zones for this project.

Sands and sandstone layers of the following aquifers are USDWs in the proposed area: Laramie-Fox Hills Aquifer; Arapahoe Aquifer; Denver Aquifer and Dawson Aquifer. Compliance with permit conditions will ensure that the Arapahoe Aquifer is protected as a USDW. The USDWs are listed in Tables 2.4A, B and C below.

Table 2.4A
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)
Well A-1

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Dawson	0	133	Shale, grey, with rare siltstone, sandy layers.
Lower Dawson	133	351	Shale, grey, with rare siltstone, sandy layers.
Denver	390	1005	Interbedded shale, sandstone, and minor coal.
Arapahoe	1005	1750	Interbedded shale, grey, and sandstone, grey, f-c. grained.
Laramie-Fox Hills	1750	N/A	Shale, grey.

Table 2.4B
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)
Well A-5

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Dawson	0	143	Siltstone, grey, with some shale, grey layers.
Lower Dawson	143	165	Sandstone, grey, fine to medium gr.
Denver	199	988	Interbedded shale, sandstone, and minor coal.
Arapahoe	1005	1550	Mostly sandstone, grey, f-med-c. gr., some interbedded shale, grey.

Table 2.4C
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)
Well A-13

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Dawson	0	51	Shale, grey.
Lower Dawson	51	60	Sandstone, dark grey, fine to medium gr., silty.
Denver	115	995	Interbedded shale, sandstone, and minor coal.
Arapahoe	955	1510	Mostly sandstone, grey, f. gr., interbedded shale and siltstone, grey.
Laramie-Fox Hills	1510	N/A	Siltstone, grey to dark grey with depth.

PART III. Well Construction (40 CFR § 146.22)

The approved well construction plans, incorporated into the Permit as Appendix A, are general representations of the construction of Wells A-1, A-5 and A-13 prior to injection. Routine maintenance and/or minor physical alterations to constructed wells are within the scope of such wells' construction. Prior to beginning any such maintenance or alterations, the Permittee shall give the Director advanced notice. Upon such notice, the Director may impose additional requirements, if necessary, to ensure USDW protection.

Wells shall be cased and cemented to prevent the movement of fluids into or between USDWs. Wells shall be constructed in accordance with 40 CFR § 147.305 and the SEO's Water Well Construction Rules. The SEO Water Well Construction Rules may be found at:

Code of Colorado Regulations, Secretary of State, State of Colorado, Department of Natural Resources, Division of Water Resources, Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction, 2 CCR 402-2, Rule 10 Minimum Construction Standards for Water Wells.

These rules along with the requirements of 40 CFR § 147.305 have been evaluated and are expected to be protective of USDWs. The SEO's Water Well Construction Rules are being used for well construction in an effort to help the Permittee and both agencies to work more efficiently when evaluating the well construction for the three approved wells (A-1, A-5 and A-13) and future wells.

Wells A-1, A-5 and A-13 have operated as recovery wells. Bench Scale and Pilot Cycle Testing consistent with Permit requirements, and additional logging and testing requirements identified in Appendix B, must be completed prior to obtaining authorization to inject.

Casing and Cement

Three wells are currently approved for construction. The well construction plans for Wells A-1, A-5 and A-13 were evaluated and determined to be in conformance with standard practices and guidelines that ensure well injection does not result in the movement of fluid containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of any primary drinking water regulation or may otherwise adversely affect the health of persons.

Well construction details for the injection wells are shown in Table 3.1.

To protect shallow USDWs when drilling the surface hole, the Permittee is limited to drilling with air or mud made with water containing no additives and no more than 3,000 mg/L TDS, unless waived by the Director.

Remedial cementing may be required if the casing cement is shown to be inadequate by a cement bond log or other demonstration of external (Part II) mechanical integrity.

**Table 3.1
WELL CONSTRUCTION REQUIREMENTS**

Well Name	Casing Type	Casing Material	Hole Size (in)	Casing Size (in)	Cased Interval (ft)	Cemented Interval (ft)	Screened Interval (ft)
A-1	Surface	steel	36	22	0-40	0-40	--
	Longstring	steel	20	12.75	0-1802	0-1080	1345-1760
A-5	Surface	steel	36	24	0-40	0-40	--
	Longstring	steel	unknown	12.75	0-1628	0-990	1055-1548
A-13	Surface	steel	38	30	0-40	0-40	--
	Longstring	steel	28	28	40-970	0-970	996-1498
	Longstring	steel	17.5	10.75	970-1538	--	

The well construction details were obtained from Well Construction and Test Report Form No. GWS-31, which was prepared for the SEO, and available online.

Sampling and Monitoring Device

To fulfill permit monitoring requirements and provide access for EPA inspections, sampling and monitoring equipment will need to be installed and maintained. Required equipment includes but is not limited to:

- 1) a pressure actuated shut-off device attached to the injection flow line set to shut-off the injection pump when or before the Maximum Allowable Injection Pressure (MAIP) is reached at the wellhead;
- 2) fittings or pressure gauges attached to the injection tubing, including a flow meter that measures flow in real time;
- 3) a fluid sampling point between the pump house or storage tanks and the injection wells, isolated by shut-off valves, for sampling the injected fluid; and
- 4) a non-resettable flow meter that records the cumulative volume of injected fluid; and continuous recording of injection pressure, flow rate, volume, and any additional monitoring requirements.

If the well construction will allow, monitoring shall also be performed at the tubing casing annulus (TCA), and surface casing-production casing (Bradenhead) annulus. Injection pressure is the pressure that is measured in a pump house or alternate location whereas wellhead pressure is measured at the top of the well. Data is evaluated to determine if there may be a problem with field operations if data shows an interruption in injection activities.

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

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

Area of Review (AOR)

Permit applicants are required to identify the location of all known wells within the AOR which penetrate the lowermost confining zone, which is intended to prevent injection fluids from migrating outside of the injection zone. Under 40 CFR § 146.6 the AOR may be a fixed radius of not less than one quarter (1/4) mile or a calculated zone of endangering influence. For area permits, a fixed width of not less than one quarter (1/4) mile for the circumscribing area may be used.

The Permittee provided a list of wells located within RMD's Service Area. Many are monitoring wells which were completed in the Dawson and Denver Aquifers. RMD owns and operates two wells that are completed in the Laramie-Fox Hills aquifer, Well LFH-11 (Permit 77883-F) and Well SR-LFH (77970-F).

The only wells within the RMD Service Area that were completed in the Arapahoe aquifer are operated by RMD. The following is a list of the Arapahoe wells RMD owns or operates:

1. Well A-1 (Permit 47701-F)
2. Well A-2 (Permit 46766-F)
3. Well A-4 (Permit 54369-F)
4. Well A-5 (Permit 54367-F)
5. Well A-13 (Permit 63493-F)
6. Well A-14 (Permit 54369-F)
7. Well A-20 (Permit 50392-F)
8. Well SR-LA/SR-UA (Permits 77971-F & 77972-F)
9. Well LA-1 (Permit 83725-F)

There were three permitted wells within a quarter mile of the outside boundary of the RMD service area. The well permits for these wells are as follows:

1. Permit 2195 (Domestic Use/Upper Arapahoe) completed in 1958 (SE/4 of the SE/4 of Section 33, Township 3 South, Range 65 West)
2. Permit 227391 (Exempt Domestic Use/Upper Arapahoe) completed in 2001 (NE/4 of the NE/4 of Section 4, Township 4 South, Range 65 West)
3. Permit 227394 (Exempt Domestic Use/Upper Arapahoe) completed in 2002 (NE/4 of the NE/4 of Section 4, Township 4 South, Range 65 West)

The three wells are located on the very northern boundary of the RMD service area. They are located approximately 6.2 miles from proposed injection Well A-13, 8.7 miles from proposed injection Well A-5, and 10 miles from proposed injection Well A-1.

A list of wells in the AOR must be updated and reported in the Annual Report that is submitted to EPA.

Corrective Action Plan (CAP)

For wells in the AOR which are improperly sealed, completed or abandoned, the applicant will develop a CAP consisting of the steps or modifications that are necessary to prevent movement of fluid into USDWs.

No corrective action is required at this time as EPA's evaluation did not identify migration pathways that would impact USDWs within the AOR.

PART V. Well Operation Requirements (40 CFR § 146.23)

Mechanical Integrity (MI) (40 CFR § 146.8)

An injection well has mechanical integrity (MI) if:

1. Internal (Part I) MI: there is no significant leak in the casing; and
2. External (Part II) MI: there is no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore.

The Permit requires MI to be maintained at all times. The Permittee must demonstrate MI prior to injection, as required in Appendix B Logging and Testing Requirements. A demonstration of well MI includes both internal (Part I) and external (Part II). The methods and frequency for demonstrating internal (Part I) and external (Part II) MI are dependent upon well conditions and are subject to change. Should well conditions change during the operating life of the well, additional requirements may be specified and will be incorporated as minor modifications to the Permit.

A successful internal Part I Mechanical Integrity Test (MIT) is required prior to receiving authorization to inject. A demonstration of internal MI is also required following any workover operation that affects the well casing or after a loss of MI. In such cases, the Permittee must complete work and restore MI within ninety (90) days following the workover or within the timeframe of the approved alternative schedule. After the well has lost MI, injection may not recommence until after internal MI has been demonstrated and the Director has provided written approval.

Internal MI may be demonstrated by performing periodic visual inspections of the injection well(s), including the well casing. Specifically, the operator must submit documentation of all video logs previously run for each proposed injection well accompanied by a report(s) from a qualified professional analyst. All video logs must be run from the top to the total depth of each proposed injection well. Analytical reports must include a discussion of all findings related to the mechanical integrity of the well, identification of any measures taken to resolve concerns and/or maintain the well, and any issues for which monitoring is needed on a regular basis. Video logs with an analyst report must be submitted to EPA prior to injection, following the repair of a well after the loss of mechanical integrity, and during routine maintenance, which is expected to occur at least every ten (10) years.

External (Part II) MIT may be demonstrated by evaluation of cement records or cement bond logs (CBLs) to show that adequate cement exists to prevent significant movement of fluid out of the

approved injection zone through the casing cement. If a CBL is run, guidance on the logging and interpretation of the CBL can be found at <https://www.epa.gov/uic/underground-injection-control-epa-region-8-co-mt-nd-sd-ut-and-wy#guidance>.

Should the cement records or CBL analysis show inadequate external Part II MI, additional periodic tests may be required.

Injection Fluid Limitation

Injection fluids are limited to fluids from those public water systems sampled and submitted as part of the application. Sources of treated drinking water to be injected shall be obtained from Alluvium, Dawson, Denver and Arapahoe Aquifers. The injectate will be treated to drinking water standards at various WTPs including Aurora, Denver and WISE WTPs. According to the Permittee, the majority of the injectate water will come from Aurora's Binney WTP, and possibly the WISE Quebec Street WTP. Injection fluid limitations are found in Part II. Section C.6 of the Permit.

Injection Pressure Limitation

40 CFR § 146.23(a)(1) requires that the injection pressure at the wellhead must not exceed a maximum calculated to ensure that the pressure during injection does not initiate new fractures or propagate existing fractures in the confining zone adjacent to the USDWs. In lieu of testing to determine the fracture pressure of the confining zone, which may be impractical, the MAIP will be set below a pressure that will not initiate new fractures or propagate existing fractures in the injection zone thereby ensuring that no injection or formation fluids will migrate out of the injection zone and into other USDWs. Based on the calculations noted below, EPA has determined that a Part I MI test pressure of up to 200 pounds per square inch gauge (psig) can be safely conducted without causing such fracturing and that the MAIP be set at 2/3 of the Part I MI test pressure. Should the Permittee wish to inject at a higher pressure, then an additional test may be required such as a Step Rate Test. Since the Permittee anticipates injecting at pressures no higher than 125 psig, EPA is setting the MAIP at 133 psig for wells A-1, A-5 and A-13.

The fracture pressure of the injection zone is determined by using the depth at the top of the well screen, a conservative fracture gradient value of 0.8 psi/foot, and a specific gravity for the injected fluid of 1.0 in the formula below. As a result, the fracture pressures are 493.62 psig for Well A-1, 387.19 psig for Well A-5, and 365.53 psig for Well A-13.

$$FP = [FG - (0.433 * SG)] * D$$

FP = Fracture Pressure
FG = Fracture Gradient
SG = Specific Gravity
D = Depth

Therefore, EPA has determined that a MAIP of 133 psig is sufficiently protective of USDWs outside of the injection zone for all three wells.

Table 5.1 provides the MAIP for the three wells which are authorized to construct for ASR
Statement of Basis

purposes.

Table 5.1
MAXIMUM ALLOWABLE INJECTION PRESSURE (MAIP) For Authorized Wells

Well	Top Screen Depth (ft)	Estimated MAIP (psi)
A-1	1345	133
A-5	1055	133
A-13	996	133

PART VI. Monitoring, Recordkeeping and Reporting Requirements

Injection Well Monitoring Program

At least once a year the Permittee must analyze a sample of the injected fluid for parameters specified in Appendix J of the Permit, based on the schedule presented in Appendix D. This analysis must be reported to EPA annually as part of the Annual Report to the Director.

Instantaneous injection pressure, injection flow rate, injection volume, and cumulative fluid volume must be observed on a weekly basis. A recording, at least monthly, must be made of that month's injected and recovered volume and cumulative fluid volume to date, and the maximum and average value for injection tubing pressure and rate. This information is required to be reported quarterly to the Director.

Injectate and Recovered Water

Treated injectate will be analyzed near the injection point(s) to determine if there have been any changes in the water quality. Recovered water from the Arapahoe Aquifer will be analyzed prior to any further treatment to determine if mobilization or any other geochemical reactions are occurring over time as a result of injection activities.

The Permittee has submitted baseline water quality data for recovered water from proposed injection wells A-1 (sampled on March 3, 2020), A-5 (sampled on November 8, 2016), and A-13 (sampled on February 13, 2020). There were no exceedances of those constituents on the national primary drinking water standards with maximum contaminant levels (MCLs).

Sampling results from 2016 from the three Aurora WTPs (Binney, Griswold and Wemlinger) and the WISE WTP at Quebec Street, which will be providing injection water to the RMD ASR project, were provided by the Permittee. In addition, results from water samples collected on December 1, 2017, from the sample point located at the Aurora Connection to the Ridgeway Tee, located on East Smoky Hill Parkway and South Powhatan Road, were submitted as a sample of injectate entering the RMD system.

Arsenic

Arsenic concentrations from all three proposed ASR wells were reported below detection limits

(BDL). Arsenic levels will be monitored annually or as required by the Director, if changed. Arsenic is being monitored to determine if there may be any mobilization occurring. Arsenic concentrations in treated water from three Aurora WTPs, Binney, Griswold and Wemlinger, and the WISE Quebec Street WTP were BDL. In the sample collected from the RMD injectate point, arsenic concentrations were also BDL.

Nitrosamines

Nitrosamine concentrations were BDL during the baseline sampling events for recovered water from the three proposed ASR wells. Concentrations of the nitrosamine N-Nitrosodimethylamine (NDMA) were reported in the sample of treated water from the Griswold WTP at a concentration of 3.2 nanograms per Liter (ng/L). In addition, NDMA concentrations in a sample from the RMD injectate point were reported at 4.9 ng/L. A summary of nitrosamine results and associated sampling locations is presented in the table below.

**Table 6.1
NDMA Concentrations**

Date	WTP or Other Location	NDMA (ng/L)
9/20/2016	Griswold	3.2
9/20/2016	Binney	BDL
9/21/2016	Wemlinger	BDL
4/24/2017	Quebec Street	BDL
12/01/2017	RMD Injectate	4.9

Nitrosamines are organic compounds, which are probable carcinogens. NDMA can be a potential degradation by-product of chloramination, which is the treatment of drinking water with a chloramine disinfectant. Both chlorine and small amounts of ammonia are added to the water sequentially, and react together to form chloramine (also called combined chlorine), resulting in a long-lasting disinfectant. The Aurora Water, Denver Water and the WISE WTPs facilities do use chloramination. Therefore, ongoing monitoring of nitrosamines shall be performed. Nitrosamines do not currently have MCLs.

Samples for nitrosamine analysis will be collected for the injectate from the tap at the wellhead(s) and from the injection zone through the approved injection wells on a quarterly basis. This information will be used to evaluate whether nitrosamines are present in the injectate, may be present in the Arapahoe aquifer, and whether it attenuates over time. A sample of the injectate from the tap at the wellhead will be obtained during the month where flows from surface water sources are at their maximum level. The peak month shall be determined by evaluating three years of monthly recovery rates at the supplying water systems. A trigger of 7 ng/L has been set for NDMA which, if exceeded, may cause EPA to re-evaluate the permit conditions.

Appendix D in the Draft Permit also requires additional sampling to be performed. EPA will
Statement of Basis

evaluate the data results in an effort to safeguard USDWs in the area during injection activities. Monitoring requirements include:

New Injection Well

New injection well requests shall be submitted in accordance with Part II. Section B.1 and Appendices B, D, H and I. Well testing for injection wells will be performed to ensure that injection activities do not endanger USDWs through the introduction or mobilization of contaminants.

New Water Source

The Permittee may add new water sources beyond those listed in the Injection Fluid Limitation section presented above. Baseline Water Quality Data and Bench Scale Test results must be collected for each new water source. The Director may require a Pilot Cycle Test be performed based on a review of prior to injection information (e.g., if there are concerns that injection of the new water source could result in mobilization). A new water source is defined as a new water treatment plant, new raw water source, or other public water systems. The Permittee shall follow the procedures identified Part II. Section C.7 and Appendices B, D, and H. The purpose of testing the new water source is to evaluate water quality prior to injection and to determine the potential formation of NDMA. Monitoring requirements for new water sources are included in Appendix D of the Permit.

Appendix G – ASR Baseline Constituent List

1. This Appendix contains a list of general constituents, anions, cations, metals, inorganics, radionuclides, volatile organic compound, semi volatile organic compounds, pesticides and herbicides, disinfectants and disinfection byproducts, and nitrosamines, and the Permit Limit for each contaminant.
2. This is a larger list of constituents analyzed to establish a baseline and to evaluate water quality for a new water source and/or the injection zone for a new well. This information is needed to ensure that future injection activities will not adversely impact human health and/or cause the mobilization of contaminants into a USDW.
3. Injection activities will not be authorized if a contaminant exceeds a Permit Limit.
4. Nitrosamines are included on this list of analytes. The reporting limits for nitrosamines were obtained from the Second Unregulated Contaminants Monitoring Rule for EPA Method 521. If constituents not currently listed in Appendix J are detected during baseline evaluations and/or exceed a Permit Limit, the Director may choose to add it to Appendix J.
5. If cyanide is detected in the source water and not alkalized (pH less than 8.5), the Permittee must remove cyanide from the source water prior to chloramination.

Appendix H – Bench-Scale Water Chemistry Test Procedures for Nitrosamines

The Permit requires a bench scale water chemistry test for the nitrosamines NDMA and N-nitroso-di-n-butylamine (NDBA) following authorization to inject by EPA. There are two main goals for this test:

- 1) collect formation water and spike it with NDMA and NDBA to evaluate the conditions associated with any attenuation or other reactions which may occur over time; and
- 2) investigate changes in water chemistry that may occur over time for the injectate as a result of water storage and recovery.

More specifically, the Permittee will collect initial source water and formation water samples for this test prior to commencing injection in order to obtain representative samples for bench-scale testing. Part A of the water chemistry bench test is expected to provide more information about the potential for NDMA and NDBA to attenuate in the Arapahoe Aquifer. Part B of the bench test is performed to evaluate the potential for NDMA and NDBA formation in the aquifer over time. The Permittee shall perform this test for new well and new water source additions. Bench scale testing of other nitrosamines may be required if they are detected in source water in the future.

Appendix I – ASR Pilot Cycle Test Procedures

A pilot cycle test is required to evaluate the potential impacts of injection for ASR on the Arapahoe Aquifer. There are three main goals for these procedures: 1) investigate the well and aquifer hydraulics and behavior during repetitive storage and recovery cycles; 2) evaluate the mechanics involved in well operation, flow and water level control, and instrumentation; and 3) investigate changes in water quality chemistry that may occur from water storage and recovery. This Appendix does not address all the details, or all of the contingencies associated with an ASR pilot-testing plan, as many of these cannot be reliably anticipated in advance of the actual testing. Rather, it is intended to provide an overall structure for conducting the pilot studies.

The Permittee shall perform this test for Wells A-1, A-5 and A-13 following authorization to inject from EPA. The test procedure under Appendix I, Section B, contains the minimum timeframes associated with injection, storage and recovery of fluids that EPA Region 8 requires at all ASR facilities. Cycle 1 will be used to optimize project operations. Cycles 2 thru 4 will be performed for a longer duration of time. For Cycles 2, 3, and 4, analysis will be performed for the constituents listed in Appendix J to evaluate any potential for mobilization of contaminants in the aquifer. The Permittee may perform a longer test for Cycle 4 which is labeled as alternate test for this cycle.

Once the test is completed, the Permittee shall submit a report to EPA in accordance with Part II, Section F.5 of the Permit. This information will inform the potential contamination risk, if any, to these aquifers resulting from injection activities. These tests will be required whenever a new well is added. The Director may require that a Pilot Cycle Test be performed when a new water source is added if there are concerns that injection activities may result in the mobilization of metals or a potential introduction of contaminants.

The following conditions must be measured and recorded in advance of, and during, the cycle testing:

1. Static water levels (between cycles)
2. Water levels while pumping
3. Water levels while injecting or specify surface, if applicable

4. Flow rate and cumulative amount pumped while recovering, by cycle and total
5. Flow rate and cumulative amount stored while injecting, by cycle and total
6. Flow rate entering and exiting the system
7. Pressure recorded from a gauge on the wellhead.
8. Inflation pressure on flow control valve.
9. Intermittent sampling for measurement of total organic carbon and dissolved oxygen in injectate and recovered water
10. Start/stop times and elapsed time for cycles
11. Sampling dates and sample testing protocol

Appendix J – Constituent List for Pilot Cycle Test Analysis and Ongoing Monitoring Requirements

The Permittee will use this shorter parameter list to evaluate water quality for the injectate and/or recovered water required in the Pilot Cycle Test procedures in Appendix I and when analytical data is required for monitoring requirements provided in Appendix D. This list may be modified based on the initial samples collected and results of pilot cycle testing.

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

Plugging and Abandonment Plan

All wells shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids either into or between USDWs in accordance with 40 CFR § 146.10. Additional federal, state or local law or regulations may also apply.

Wells authorized under this Permit, must be either transferred out of the program or plugged and abandoned. RMD will notify EPA with any plans to permanently abandon the well. The Director will review and approve any plugging and abandonment plans prior to RMD implementing any such plans.

Within thirty (30) days after plugging the owner or operator must submit a Plugging Record (EPA Form 7520-19) to the Director. The Plugging Record must be certified as accurate and complete by the person responsible for the plugging operation. The plugging and abandonment plan is described in Appendix E of the Permit.

PART VIII. Considerations Under Other Federal Law (40 CFR § 144.4)

EPA will ensure that issuance of this Permit will be in compliance with the laws, regulations and orders described at 40 CFR § 144.4, including the National Historic Preservation Act, the Endangered Species Act, and Executive Order 12989 (Environmental Justice), before a final permit decision is made.

National Historic Preservation Act (NHPA)

Section 106 of the National Historic Preservation Act, 54 U.S.C. § 306108, requires federal agencies to consider the effects on historic properties of actions they authorize, fund or carry out. EPA has determined that a decision to issue a Class V injection well permit for authorization of injection into the well constitutes an undertaking subject to the National Historic Preservation Act and its implementing regulations at 36 CFR part 800.

No planned ASR activities for this phase of the project will affect historical properties. The wells are built, have operated for recovery and may require workover activities that will not impact surrounding areas. All roads are in place, and injection fluid will be transported to the site via existing infrastructure. Therefore, EPA has concluded that there will be “no adverse effect” on historic properties.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act (ESA), 16 U.S.C. § 1536 (a)(2), requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of federally-listed endangered or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. EPA has determined that a decision to issue a Class V permit for authorization of injection into the wells constitutes an action that is subject to the Endangered Species Act and its implementing regulations (50 CFR part 402).

Federally-listed species which may occur in the RMD project area include the following:

- Least Tern
- Mexican Spotted Owl
- Pallid Sturgeon
- Piping Plover
- Preble’s Meadow Jumping Mouse
- Ute’s Ladies Tresses
- Western Prairie Fringed Orchid
- Whooping Crane

In a Memo to File dated August 12, 2020, EPA conducted an Endangered Species Act Evaluation based on publicly available information. Items reviewed included documents associated with The Lowry Range, the basin-wide Platte River Recovery Implementation Program and information available from the U.S. Fish and Wildlife Service Information and Planning and Consultation System (IPac).

The proposed ASR wells, pipelines and WTPs are existing. Other than minimal work over requirements on the equipment inside the ASR wells, no other alterations will be made to the various sites associated with this ASR project. These work over activities are similar to any work that would be carried out during typical well operations and therefore do not pose a threat or impact to these listed species or their habitat. Therefore, no impacts are anticipated from the conversions to, and operation of, ASR wells.

The wells proposed for ASR injection, Wells A-1, A-5 and A-13, are existing recovery wells. Other than minimal work over activity on the equipment inside the wells, no other alterations will be made to the sites. These activities are similar to any work that would be carried out during typical well operations and therefore do not pose a threat or impact to these listed species or their habitat. Therefore, no effects are anticipated from the conversions to, and operation of, ASR wells.

Executive Order 12898

On February 11, 1994, the President issued Executive Order 12898, entitled “Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations.” EPA has concluded that there may be potential EJ communities proximate to the Authorized Permit Area. The primary potential human health or environmental effects to these communities associated with injection well operations would be to local aquifers that are currently being used or may be used in the future as USDWs. EPA’s UIC program authority under the Safe Drinking Water Act is designed to protect USDWs through the regulation of underground injection wells. EPA has concluded that the specific conditions of UIC Permit CO52414-00000 will prevent contamination to USDWs, including USDWs which either are or will be used in the future by communities of EJ concern. The UIC program will be conducting enhanced public outreach to EJ communities by publishing a public notice announcement in local newspapers and holding a public hearing, if requested, or if public interest in the proposed permit is high.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PROGRAM



DRAFT AREA PERMIT

CO52414-00000

Rangeview Metropolitan District
Class V Aquifer Storage and Recovery Wells
Arapahoe County, Colorado

Issued To

Rangeview Metropolitan District
34501 East Quincy Avenue, Bldg. 34, Box 10
Watkins, Colorado 80137

TABLE OF CONTENTS

TABLE OF CONTENTS	ii
PART I. AUTHORIZATION TO CONSTRUCT AND OPERATE	1
PART II. SPECIFIC PERMIT CONDITIONS	6
<i>Section A. LIST OF WELLS</i>	<i>6</i>
<i>Section B. WELL CONSTRUCTION REQUIREMENTS</i>	<i>6</i>
1. <i>Requesting Authorization of Additional Injection Wells</i>	<i>6</i>
2. <i>Authorization to Construct Additional Injection Wells</i>	<i>7</i>
3. <i>Casing and Cement</i>	<i>7</i>
4. <i>Sampling and Monitoring Devices</i>	<i>7</i>
5. <i>Pre-Injection Logs and Tests</i>	<i>7</i>
6. <i>Postponement of Construction or Conversion to Injection Wells</i>	<i>8</i>
<i>Section C. WELL OPERATION</i>	<i>8</i>
1. <i>Outermost Casing Injection Prohibition</i>	<i>8</i>
2. <i>Requirements Prior to Receiving Authorization to Inject</i>	<i>8</i>
3. <i>Injection Zone and Fluid Movement</i>	<i>9</i>
4. <i>Injection Pressure Limitation</i>	<i>9</i>
5. <i>Injection Volume Limitation</i>	<i>9</i>
6. <i>Injection Fluid Limitation</i>	<i>9</i>
7. <i>Addition of a New Water Source</i>	<i>9</i>
8. <i>Alteration, Workover, and Well Stimulation</i>	<i>10</i>
9. <i>Well Logging and Testing</i>	<i>10</i>
10. <i>Exceedances of Permit Limits</i>	<i>10</i>
11. <i>Reopening Permit for Modification or Revocation and Reissuance</i>	<i>11</i>
<i>Section D. MECHANICAL INTEGRITY</i>	<i>11</i>
1. <i>Requirement to Maintain Mechanical Integrity</i>	<i>11</i>
2. <i>Demonstration of Mechanical Integrity</i>	<i>11</i>

3.	<i>Mechanical Integrity Test Methods and Criteria</i>	12
4.	<i>Notification Prior to Testing</i>	12
5.	<i>Loss of Mechanical Integrity</i>	12
Section E. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS		12
1.	<i>Monitoring Parameters and Frequency</i>	12
2.	<i>Monitoring Methods</i>	12
3.	<i>Records Retention</i>	13
4.	<i>Annual Reports</i>	13
Section F. PLUGGING AND ABANDONMENT		14
1.	<i>Notification of Well Abandonment</i>	14
2.	<i>Well Plugging Requirements</i>	14
3.	<i>Approval of Plugging and Abandonment (P&A) Plan</i>	14
4.	<i>Plugging and Abandonment Report</i>	14
5.	<i>Wells Not Actively Injecting</i>	14
PART III. CONDITIONS APPLICABLE TO ALL PERMITS		15
Section A. 40 CFR 144.12 REQUIREMENTS		15
1.	<i>Prohibition of movement of fluids into an underground source of drinking water</i>	15
2.	<i>Identification of a Violation, 40 CFR 144.12(c)</i>	15
3.	<i>Adversely Affect Human Health, 40 CFR 144.12(d)</i>	15
Section B. CHANGES TO PERMIT CONDITIONS		15
1.	<i>Modification, Revocation and Reissuance, or Termination</i>	15
2.	<i>Conversion to Non-UIC Well</i>	15
3.	<i>Transfer of Permit</i>	15
4.	<i>Permittee Change of Address</i>	16
Section C. SEVERABILITY		16
Section D. CONFIDENTIALITY		16
Section E. ADDITIONAL PERMIT REQUIREMENTS		16
1.	<i>Duty to Comply</i>	16
2.	<i>Need to Halt or Reduce Activity Not a Defense</i>	17
3.	<i>Duty to Mitigate</i>	17

4.	<i>Proper Operation and Maintenance</i>	17
5.	<i>Permit Actions</i>	17
6.	<i>Property and Private Rights; Other Laws</i>	17
7.	<i>Duty to Provide Information</i>	17
8.	<i>Inspection and Entry</i>	17
9.	<i>Signatory Requirements</i>	18
10.	<i>Continuation of Expiring Permits</i>	18
11.	<i>Reporting Requirements</i>	18

TABLES

Table 1-	Legal Description RMD Service Area.....	3
----------	---	---

FIGURES

Figure 1-	RMD Property Map.....	2
-----------	-----------------------	---

APPENDICES

Appendix A –	WELL CONSTRUCTION REQUIREMENTS.....	A-1
Appendix B –	LOGGING AND TESTING REQUIREMENTS.....	B-1
Appendix C –	OPERATING REQUIREMENTS.....	C-1
Appendix D –	MONITORING AND REPORTING REQUIREMENTS	D-1
Appendix E –	PLUGGING AND ABANDONMENT REQUIREMENTS	E-1
Appendix F –	CORRECTIVE ACTION PLAN	F-1
Appendix G –	ASR BASELINE CONSTITUENT LIST	G-1
Appendix H –	BENCH SCALE WATER CHEMISTRY PROCEDURES.....	H-1
Appendix I –	ASR PILOT CYCLE TEST PROCEDURES	I-1
Appendix J –	CONSTITUENTS FOR PILOT CYCLE TEST ANALYSIS AND ONGOING MONITORING REQUIREMENTS.....	J-1

PART I. AUTHORIZATION TO CONSTRUCT AND OPERATE

Under the authority of the Safe Drinking Water Act (SDWA) and Underground Injection Control (UIC) Program regulations of the U. S. Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations (40 CFR) parts 2, 124, 144, 146, and 147, and according to the terms of this permit (Permit),

Rangeview Metropolitan District
34501 East Quincy Avenue, Bldg. 34, Box 10
Watkins, Colorado 80137

hereinafter referred to as the "Permittee," is authorized to construct and to operate Class V Aquifer Storage and Recovery (ASR) injection wells according to the terms and conditions of this Permit underlying the Rangeview Metropolitan District (RMD) Service Area located in Arapahoe County, Colorado.

Currently, only wells A-1, A-5 and A-13 are authorized for construction and operation, including conversion from a recovery well to a recovery well and injection well, within the service field area.

- **Well A-1**
DWR Permit No. 44701-F, EPA 52414-11964
100 feet from the south line and 2600 feet from the west line
SE $\frac{1}{4}$ SW $\frac{1}{4}$, Section 22, Township 5 South, Range 65 West
Arapahoe County, Colorado
- **Well A-5**
DWR Permit No. 54367-F, EPA 52414-11965
2600 feet from the north line and 2400 feet from the east line
SW $\frac{1}{4}$ NE $\frac{1}{4}$, Section 14, Township 5 South, Range 65 West
Arapahoe County, Colorado
- **Well A-13**
DWR Permit No. 63493-F, EPA 52414-12008
1360 feet from the north line and 170 feet from the west line
SW $\frac{1}{4}$ NW $\frac{1}{4}$, Section 3, Township 5 South, Range 65 West
Arapahoe County, Colorado

The wells are located wholly within the RMD Service Area as shown in Figure 1, with the legal description identified in Table 1:

Figure 1. RMD Property Map

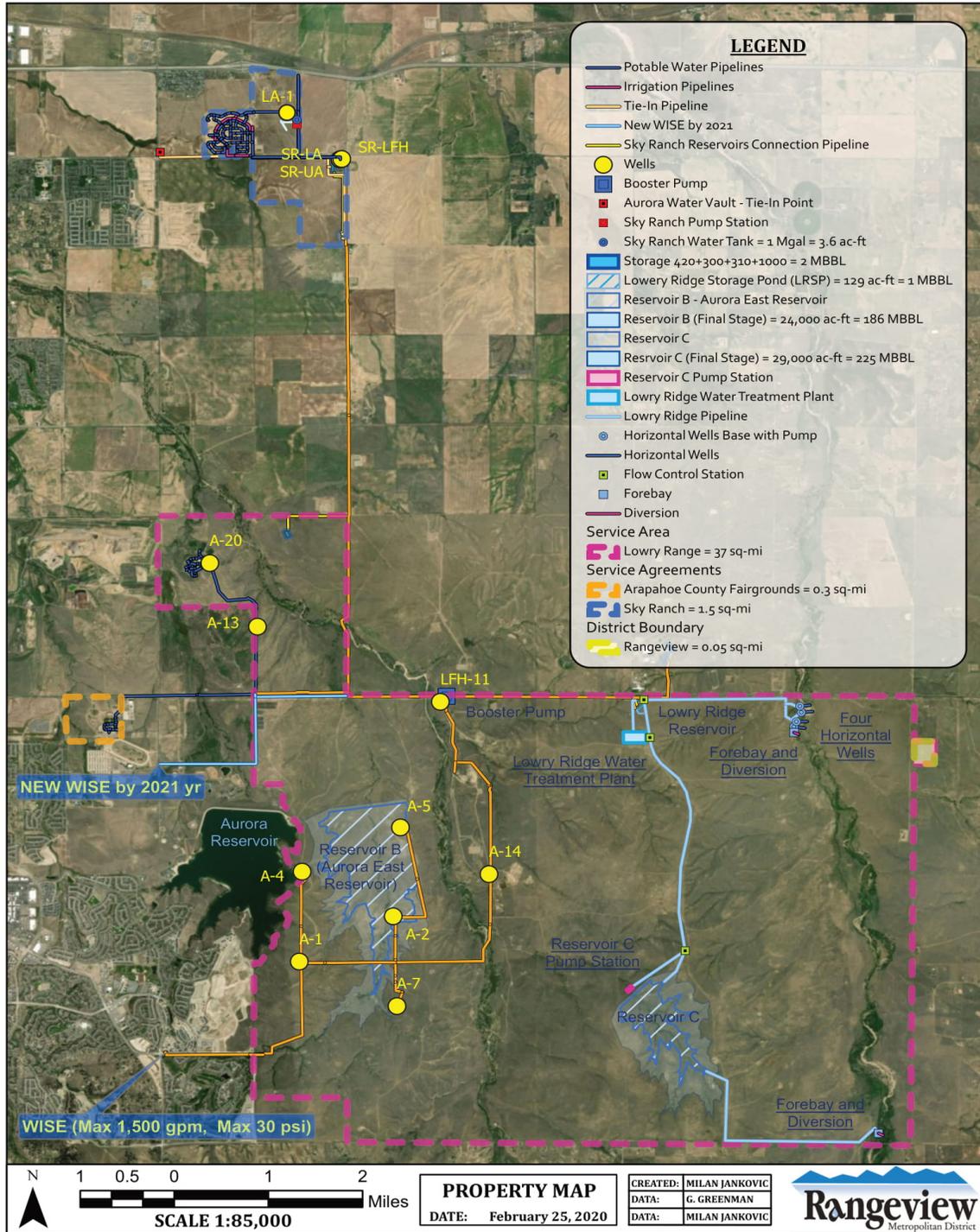


Table 1. Legal Description of RMD Service Area

RMD SERVICE AREA	
Township 7 South, Range 67 W, Section 21 SW/4 of SW/4	Township 8 South, Range 67 W, Section 9
Township 7 South, Range 67 W, Section 22 SW/3 of SW/4, E/2 of SW/4, SE/4	Township 8 South, Range 67 W, Section 10
Township 7 South, Range 67 W, Section 23 NE/4, SE/4, SW/4, SW/4 of NW/4, SE/4 of NW/4	Township 8 South, Range 67 W, Section 11
Township 7 South, Range 67 W, Section 24 NW/4 of NW/4, S/2 of NW/4, SW4, SE4	Township 8 South, Range 67 W, Section 12
Township 7 South, Range 67 W, Section 25	Township 8 South, Range 67 W, Section 13
Township 7 South, Range 67 W, Section 26	Township 8 South, Range 67 W, Section 14
Township 7 South, Range 67 W, Section 27	Township 8 South, Range 67 W, Section 15
Township 7 South, Range 67 W, Section 28	Township 8 South, Range 67 W, Section 16
Township 7 South, Range 67 W, Section 29 SE/4, SE/4 of SW/4	Township 8 South, Range 67 W, Section 21
Township 7 South, Range 67 W, Section 32 E/2, E/2 of NW/4, E/2 of SW/4	Township 8 South, Range 67 W, Section 22
Township 7 South, Range 67 W, Section 33	Township 8 South, Range 67 W, Section 23
Township 7 South, Range 67 W, Section 34	Township 8 South, Range 67 W, Section 24
Township 7 South, Range 67 W, Section 35	Township 8 South, Range 67 W, Section 25
Township 7 South, Range 67 W, Section 36	Township 8 South, Range 67 W, Section 26
Township 7 South, Range 66 W, Section 19 S/2	Township 8 South, Range 67 W, Section 27
Township 7 South, Range 66 W, Section 20 S/2	Township 8 South, Range 67 W, Section 28
Township 7 South, Range 66 W, Section 21 S/2	Township 8 South, Range 67 W, Section 29 E/2
Township 7 South, Range 66 W, Section 22 SW/4 of NW/4, W/2 of SW/4	Township 8 South, Range 67 W, Section 32 NE/4
Township 7 South, Range 66 W, Section 27 N/2 of NW/4	Township 8 South, Range 67 W, Section 33 N/2
Township 7 South, Range 66 W, Section 28 W/2, N/2 of SE/4	Township 8 South, Range 66 W, Section 4 W/2
Township 7 South, Range 66 W, Section 29	Township 8 South, Range 66 W, Section 5
Township 7 South, Range 66 W, Section 30	Township 8 South, Range 66 W, Section 6

RMD SERVICE AREA	
Township 7 South, Range 66 W, Section 31	Township 8 South, Range 66 W, Section 7
Township 7 South, Range 66 W, Section 32	Township 8 South, Range 66 W, Section 8
Township 7 South, Range 66 W, Section 33 W/2	Township 8 South, Range 66 W, Section 9 W/2, W/2 of SE/4
Township 8 South, Range 67 W, Section 1	Township 8 South, Range 66 W, Section 17
Township 8 South, Range 67 W, Section 2	Township 8 South, Range 66 W, Section 18
Township 8 South, Range 67 W, Section 3	Township 8 South, Range 66 W, Section 19 W/4 of SW/4, W/8 of NW/4
Township 8 South, Range 67 W, Section 4	Township 8 South, Range 66 W, Section 30 W/2, SW/4 of SE/4
Township 8 South, Range 67 W, Section 5, E/2, E/2 of NW/4	

This Permit is based on representations made by the applicant and on other information contained in the administrative record. Misrepresentation of information or failure to fully disclose all relevant information may be cause for termination, revocation and reissuance, or modification of this Permit and/or formal enforcement action. It is the Permittee's responsibility to read and understand all provisions of this Permit.

Where a state or tribe is not authorized to administer the UIC program under the SDWA, EPA regulates underground injection of fluids into wells so that injection does not endanger Underground Sources of Drinking Water (USDWs). EPA UIC permit conditions are based on authorities set forth at 40 CFR parts 144 to 147 and address potential impacts to USDWs. Under 40 CFR part 144, subpart D, certain conditions apply to all UIC permits and may be incorporated either expressly or by reference. Regulations specific to injection wells in Colorado are found at 40 CFR §§ 147.301 and 147.305. The Permittee shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluids containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of any primary drinking water regulation or may otherwise adversely affect the health of persons.

The Permittee is authorized to engage in underground injection in accordance with the conditions of this Permit. Any underground injection activity not authorized by this Permit or by rule is prohibited.

Compliance with the terms of this Permit does not constitute a defense to any enforcement action brought under the provisions of Section 1431 of the SDWA or any other law governing protection of public health or the environment, nor does it serve as a shield to the Permittee's independent obligation to comply with all UIC regulations. Nothing in this Permit relieves the Permittee of any duties under applicable regulations.

This Permit duration is for three (3) years from the Final Permit Effective Date, until it expires under the terms of the Permit, or unless modified, revoked and reissued, or terminated under 40 CFR §§ 124.5, 144.12, 144.39, 144.40 or 144.41.

Issue Date: _____ DRAFT _____

Effective Date __ DRAFT _____

X DRAFT

Sarah Bahrman

Signed by: SARAH BAHRMAN

Sarah Bahrman
Chief*, Safe Drinking Water Branch
Water Division

* Throughout this Permit the term “Director” refers to the Safe Drinking Water Branch Chief or the Water Enforcement Branch Chief.

PART II. SPECIFIC PERMIT CONDITIONS

Section A. LIST OF WELLS (LW)

Injection wells regulated by EPA and subject to the terms and conditions of this Permit are listed below:

- **Well A-1**
DWR Permit No. 44701-F, EPA 52414-11964
100 feet from the south line and 2600 feet from the west line
SE ¼ SW ¼, Section 22, Township 5 South, Range 65 West
Arapahoe County, Colorado

- **Well A-5**
DWR Permit No. 54367-F, EPA 52414-11965
2600 feet from the north line and 2400 feet from the east line
SW ¼ NE ¼, Section 14, Township 5 South, Range 65 West
Arapahoe County, Colorado

- **Well A-13**
DWR Permit No. 63493-F, EPA 52414-12008
1360 feet from the north line and 170 feet from the west line
SW ¼ NW ¼, Section 3, Township 5 South, Range 65 West
Arapahoe County, Colorado

EPA Region 8 will maintain a LW that are added to this Permit. This list will be available to the Permittee and the public upon request. Injection wells regulated by EPA and subject to the terms and conditions of this Permit are listed in the LW with EPA Permit No. CO52414 and are assigned a unique well identification number by EPA.

Section B. WELL CONSTRUCTION REQUIREMENTS

The Permittee shall not convert recovery wells to injection wells or commence injection into wells until the Permittee has been approved to do so in accordance with the following procedures:

1. Requesting Authorization of Additional Injection Wells

Prior to converting any additional existing drinking water supply (i.e., recovery) wells to injection wells, the Permittee shall submit the following materials to the Director:

- (a) a cover letter requesting authorization to convert the well referencing Area UIC Permit CO52414-00000, the well name, and the Colorado Division of Water Resources (DWR) Permit number for the well;
- (b) a completed EPA 7520-6 (Class V) injection well application form with the applicable attachments;
- (c) evidence and/or written statement that water feed lines have been installed to the requested well(s);
- (d) a laboratory analysis of formation water drawn from the subject well(s) proposed to be

- added, using Appendix G Parameters or a statement that the water sample will be obtained during well construction and submitted in accordance with Appendix A;
- (e) a topographic map extending to at least ¼ mile radius Area of Review (AOR) for the well;
 - (f) a wellbore diagram;
 - (g) pump rate test data results;
 - (h) a listing of all wells penetrating the confining zone within the ¼ mile AOR, and cementing records and/or cement bond logs for all wells not previously submitted and evaluated by EPA (for both injection and AOR wells); and
 - (i) a well location plat map for the requested injection well.

2. *Authorization to Construct Additional Injection Wells*

Once EPA has confirmed that the proposed well (s) meets the Permit conditions, the Director will authorize construction and operation, including conversion from a recovery well to a recovery and injection well, by email or other written communication to the Permittee.

3. *Casing and Cement*

Casing and Cement requirements are specified in Appendix A.

4. *Sampling and Monitoring Devices*

The Permittee shall install and maintain in good operating condition:

- (a) a pressure actuated shut-off device attached to the injection flow line set to shut-off the injection pump when or before the Maximum Allowable Injection Pressure (MAIP) is reached at the wellhead;
- (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 MAIP described in Part II, Section C.4 on:
 - (i) the wellhead casing; and
 - (ii) the injection tubing string(s);
- (c) a sampling port such that samples shall be collected at a location that ensures they are representative of the injected fluid. For example, a fluid sampling point between the pump house or storage tanks and the injection well, isolated by shut-off valves, for sampling the injected fluid;
- (d) a flow meter capable of recording instantaneous flow rate and cumulative volume attached to the injection line; and continuous recording devices to monitor injection pressure, flow rate, and volume; and
- (e) an inflatable bladder system that will prevent further injection and/or the backflow of injectate from the injection zone once excessive pressures are observed.

5. *Pre-Injection Logs and Tests*

Well logging and testing requirements prior to receiving authorization to inject are found in Appendix B. Well logs and tests shall be performed according to current EPA-approved procedures, or alternate

procedures approved by the Director. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation. Limited injection is permissible prior to receiving authorization to inject only for the purposes of conducting the initial well logs and tests required in Appendix B.

6. *Postponement of Construction or Conversion to Injection Wells*

- (a) For the three wells (A-1, A-5 and A-13) to be initially converted, or future wells added to this Area Permit for conversion to injection, the Permit shall expire if well conversion has not begun within two years of the Effective Date of the Permit.
- (b) The Permittee may request a one-time extension of the permit expiration date, not to exceed an additional six months, which must be made prior to expiration of the Permit. Notification shall be in writing and state the reasons for the delay, provide an estimated completion date, and list additional wells within the AOR that were not included in the initial permit application. For those newly completed AOR wells that penetrate the upper confining zone, a well construction diagram, cement records and/or cement bond logs are also required.

Once the Permit has expired under this part, the Permittee will need to reapply for a UIC permit and restart the complete permit process, including opportunity for public comment, before injection can occur.

- (c) For future wells added to this Permit that have not been constructed, if authorization to inject has not been provided within two years of the spud date, the Permittee is subject to the conditions found in Part II, Section F.5. *Wells Not Actively Injecting* or may elect to convert the well to a non-UIC well found in Part III, Section B.2 *Conversion to Non-UIC Well*.

Section C. WELL OPERATION

1. *Outermost Casing Injection Prohibition*

Injection between the outermost casing protecting USDWs and the well bore is prohibited.

2. *Requirements Prior to Receiving Authorization to Inject*

Well injection may commence only after all well construction and pre-injection requirements have been met and a written authorization to commence injection has been obtained from the Director.

In order to obtain written authorization to inject, the following must be satisfied:

- (a) The Permittee has:
 - (i). submitted a cover letter referencing Area UIC Permit CO52414-00000, the well name and Colorado DWR Permit number of the constructed injection well;
 - (ii). submitted to the Director a notice of completion of construction and a completed EPA Form 7520-18 and required attachments. The Permittee shall also provide a revised well diagram and a description of the modification to the well construction;
 - (iii). conducted all applicable logging and testing requirements found in Appendix B and submitted required records to the Director.

The logging and testing requirements include demonstration of mechanical integrity, in accordance with the conditions found in Part II, Section D of this Permit; and
(iv). satisfied requirements for corrective action in Appendix F, if applicable.

- (b) The Director has received and reviewed the documentation associated with the requirements in Paragraph 2(a) of this section and finds it is in compliance with the conditions of the Permit.
- (c) The Director has inspected the injection well and finds it is in compliance with the conditions of the Permit. If the Permittee has not received notice from the Director of his or her intent to inspect the injection well within 13 days of the date of the notice in Paragraph 2(a)(i) above, then prior inspection is waived.

3. Injection Zone and Fluid Movement

Injection zone means “a geological formation, group of formations, or part of a formation receiving fluids through a well.”

Injection and perforations are permitted only within the approved injection zone specified in Appendix C. Injected fluids shall remain within the injection zone. If monitoring indicates the movement of fluids from the injection zone, the Permittee shall notify the Director within twenty-four (24) hours and submit a written report that documents circumstances that resulted in movement of fluids beyond the injection zone.

4. Injection Pressure Limitation

- (a) Injection pressure at the wellhead shall not initiate new fractures or propagate existing fractures in the confining or injection zones. In no case shall injection pressure cause the movement of injectate or formation fluids outside of the specified injection zone.
- (b) Injection pressure shall not exceed the MAIP identified in Appendix C.

5. Injection Volume Limitation

Injection volume is limited to the total volume specified in Appendix C.

6. Injection Fluid Limitation

Injected fluids are limited to fluids from those public water systems sampled and submitted as part of the application (listed below). Sources of treated drinking water to be injected shall be obtained from Alluvium, Dawson, Denver, Arapahoe and Laramie-Fox Hills Aquifers.

The injectate will be treated to drinking water standards at the following water treatment plants (WTPs): Aurora Binney, Griswold and Wemlinger WTPs and the WISE Quebec Street WTP.

New water sources and/or the use of alternate treatment facilities may be added to the list of allowed injection fluid water sources in accordance with the procedures presented in Part II. Section C.7, *Addition of a New Water Source*, and in accordance with the procedures in 40 CFR § 144.41. The Permittee must obtain prior written approval from the Director before injecting fluids from a new source.

7. Addition of a New Water Source

It is anticipated that new raw water sources and other public water systems may be included in the future as part of this ASR project. Water from additional raw water sources, public water systems and/or WTPs not approved under Part II. Section C.6 would be considered new sources.

- (a) Requirements for the addition of a new water source are as follows:
 - (i). Prior to the introduction of a new water source (e.g. additional raw water source, different public water system or treatment plant within that system), the Permittee shall provide notification to the Director;
 - (ii). The notification shall identify the new water source, describe the treatment process with a written narrative and diagram(s), and include a representative sample analysis of the new injection fluid collected using the baseline constituent list provided in Appendix G;
 - (iii). EPA will require the performance of additional tests, including testing in accordance with Appendix H, following review of the submittal; and
 - (iv). EPA may require the performance of additional tests, including testing in accordance with Appendix I, following review of the submittal;

- (b) EPA will review the submission to ensure it meets permit conditions. Any additional authorizations to inject a new water source will be in the form of an email or other written communication to the Permittee; and

- (c) The Permittee shall perform monitoring in accordance with Appendix D.

8. Alteration, Workover, and Well Stimulation

Alterations and workovers shall meet all conditions of the Permit. Alterations and workovers include any activity that physically changes the well construction or injection formation.

Prior to beginning any addition or physical alteration to an injection well's construction or injection formation, the Permittee shall give advanced notice to the Director. Substantial alterations or additions may be cause for modification to the Permit and may include additional testing or monitoring requirements.

The Permittee shall record all alterations and workovers on a Well Rework Record (EPA Form 7520-19) and submit a revised well construction diagram when the well construction has been modified. The Permittee shall provide this and any other record of well workover or test data to EPA within sixty (60) days of completion of the activity.

The Permittee shall complete any activity which affects the tubing or casing and provide demonstration of internal (Part I) MI within ninety (90) days of beginning the activity. If the Permittee is unable to complete work within the specified time period, the Permittee shall propose an alternative schedule and obtain Director's written approval. Injection operations shall not resume until the well has successfully demonstrated mechanical integrity. If the well lost mechanical integrity, the Permittee must receive written approval from the Director to recommence injection.

9. Well Logging and Testing

Well logging and testing requirements are found in Appendix B. The Permittee shall ensure the log and test requirements are performed within the time frames specified in Appendix B. Well logs and tests shall be performed according to current EPA-approved procedures. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation.

10. Exceedances of Permit Limits

If exceedance(s) of a permit limit listed in the Appendix G is observed in the injectate and/or recovered water during normal operations, the Permittee shall resample the fluid source within 14 days. Should

a second exceedance be observed, the applicant must shut in the well until the problem is resolved to the Director's satisfaction.

11. Reopening Permit for Modification or Revocation and Reissuance

- (a) If concentrations of the nitrosamine N-nitrosodimethylamine (NDMA), in two consecutive quarterly (i.e. every 90 days, as required in Appendix D) samples of injectate and/or recovered water exceed seven (7) nanograms per Liter (ng/L) (i.e., the Integrated Information System (IRIS) based value for 10^5 increased cancer risk), the Permittee shall commence monthly monitoring and agrees that the Director may open the Permit for modification or revocation and reissuance.
- (b) If an exceedance(s) as described above in Part II Section C.10 is observed, the Permittee agrees that the Director may open the Permit for modification or revocation and reissuance.

Section D. MECHANICAL INTEGRITY

1. Requirement to Maintain Mechanical Integrity

The Permittee is required to ensure the injection well maintains mechanical integrity (MI) at all times. Injecting into a well that lacks MI is prohibited.

An injection well has MI if:

- (a) there is no significant leak in the casing, (internal Part I); and
- (b) there is no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore (external Part II).

2. Demonstration of Mechanical Integrity

- (a) Prior to receiving authorization to inject, as specified in Appendix B, the Permittee shall demonstrate internal Part I MI. Well-specific conditions dictate the methods and the frequency for demonstrating MI. The due date for completing the test is specified in Appendix B. The method that shall be used to demonstrate Part I MI is as follows:

Internal MI may be demonstrated by performing periodic visual inspections of the injection wells including the well casing. Specifically, the operator must submit documentation of all video logs previously run for each proposed injection well accompanied by a report(s) from a qualified professional analyst. Video logs shall be run in accordance with Appendix B conditions. Video logs shall be conducted within one (1) year of the Effective Permit Date. All video logs must be run from the top to the total depth of each proposed injection well. Analytical reports should include a discussion of all findings related to mechanical integrity of the well, identification of any measures taken to resolve concerns and/or maintain the well, and any issues for which monitoring is needed on a routine basis. Video logs with an analyst report must be submitted to EPA prior to injection, following the repair of a well after the loss of mechanical integrity, and during routine maintenance which is expected to occur at least every ten (10) years.

- (b) Part II MI shall be demonstrated by providing cement well records and/or a cement bond log (CBL).
- (c) The Director may require additional or alternative tests if the results presented by the operator are not satisfactory to the Director to demonstrate there is no movement of fluid into or between USDWs resulting from the injection activity.

Results of any MIT required by this Permit shall be submitted to the Director as soon as possible, but no later than thirty (30) calendar days after the test is complete.

3. Mechanical Integrity Test Methods and Criteria

EPA approved methods shall be used to demonstrate MI. The approved methods for this ASR project are described above, Page 11, Section D.2. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation.

4. Notification Prior to Testing

The Permittee shall notify the Director at least thirty (30) calendar days prior to any MIT. The Director may allow a shorter notification period if it would be sufficient to enable EPA to witness the MIT or EPA declines to witness the test. Notification may be in the form of a yearly or quarterly schedule of planned MITs, or it may be on an individual basis.

5. Loss of Mechanical Integrity

If the well fails to demonstrate MI during a test or a loss of MI becomes evident during operation (i.e. water flowing at the surface, etc.), the Permittee shall notify the Director within twenty-four (24) hours (see Part III, Section D.11(e) of this Permit), cease injection and shut-in the well within forty-eight (48) hours unless the Director requires immediate shut-in.

Within five (5) calendar days, the Permittee shall submit a follow-up written report that documents circumstances that resulted in the MI loss and how it was addressed. If the MI loss has not been resolved, the Permittee shall provide a report with the proposed plan and schedule to reestablish MI. A demonstration of MI shall be reestablished within ninety (90) calendar days of any loss of MI unless written approval of an alternate time period has been given by the Director.

Injection operations shall not resume until after the MI loss has been resolved, the well has demonstrated MI pursuant to Part II, Section D.1 of this Permit, and the Director has provided written approval to resume injection.

Section E. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS

1. Monitoring Parameters and Frequency

Monitoring parameters are specified in Appendix D. The listed parameters are to be monitored, recorded and reported at the frequency indicated in Appendix D, even when the well is not operating. In the event the well has not injected or is no longer injecting, the monitoring report will reflect its status. Sampling data shall be submitted if the well has injected any time during the reporting period.

Records of monitoring information shall include:

- (a) the date, exact place, and time of the observation, sampling, or measurements;
- (b) the individual(s) who performed the observation, sampling, or measurements;
- (c) the date(s) of analyses and individuals who performed the analyses;
- (d) the analytical technique or method used; and
- (e) the results of such analyses.

2. *Monitoring Methods*

Observations, measurements, and samples taken for the purpose of monitoring shall be representative of the monitored activity and include:

- (a) Methods used to monitor the nature of the injected fluids must comply with analytical methods cited and described in 40 CFR § 136.3 or by other methods that have been approved in writing by the Director;
- (b) Injection rate, injected/recovered volume, cumulative injected/recovered volume, and well head pressure observed and recorded at the well head. All parameters shall be observed simultaneously to provide a clear depiction of well operation;
- (c) Pressures are to be measured in pounds per square inch (psig);
- (d) Fluid volumes are to be measured in gallons; and
- (e) Injection rates are to be measured in gallons.

3. *Records Retention*

The Permittee shall retain records of all monitoring information, including the following:

- (a) Calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this Permit, and records of all data used to complete the application for this Permit, for a period of at least (3) years from the date of the sample, measurement, report, or application. This period may be extended any time prior to its expiration by request of the Director.
- (b) Nature and composition of all injected fluids until three (3) years after the completion of any plugging and abandonment (P&A) procedures specified under 40 CFR § 144.52(a)(6). The Permittee shall continue to retain the records after the three-year (3) retention period unless the Permittee delivers the records to the Regional Administrator, or his/her authorized representative, or obtains written approval from the Regional Administrator, or his/her authorized representative, to discard the records.

4. *Annual Reports*

Regardless of whether the well is operating, the Permittee shall submit an Annual Report to the Director that:

- (a) summarizes the results of the monitoring required in Part II, Sections D and E and Appendix D;
- (b) includes a summary of any major changes in characteristics or sources of injected fluid. The report of fluids injected during the year must identify each new fluid source by water treatment plant and identify each well name and location, and the field name or facility name; and
- (c) includes any additional wells within the area of review that have not previously been submitted. For those wells that penetrate the injection zone, a well construction diagram, and cement records and/or cement bond log, are also required.

The first Annual Report shall cover the period from the effective date of the Permit through December 31 of that year. Subsequent Annual Reports shall cover the period from January 1 through December 31 of the reporting year. Annual Reports shall be submitted by February 15 of the year following data collection. EPA Form 7520-8 or 7520-11 may be used or adapted to submit the Annual Report, however, the monitoring requirements specified in this Permit are mandatory even if EPA form indicates otherwise. An electronic form may also be obtained from EPA to satisfy reporting requirements.

Section F. PLUGGING AND ABANDONMENT

1. Notification of Well Abandonment

The Permittee shall notify the Director in writing at least thirty (30) days prior to plugging and abandoning an injection well.

2. Well Plugging Requirements

Prior to abandonment, the injection well shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids outside of the injection zone(s). Additional federal, state or local laws or regulations may also apply.

3. Approval of Plugging and Abandonment (P&A) Plan

The Permittee shall submit a proposed P&A Plan to the Director for approval that meets the requirements in Appendix E at least sixty (60) days prior to plugging and abandoning the injection well(s) covered under this area permit.

4. Plugging and Abandonment Report

Within sixty (60) days after plugging a well, the Permittee shall submit a report (EPA Form 7520-19) to the Director or his/her authorized representative. The plugging report shall be certified as accurate by the person who performed the plugging operation. Such report shall consist of a statement that the well was plugged in accordance with current regulations.

5. Wells Not Actively Injecting

After any period of two (2) years during which there is no injection, the Permittee shall plug and abandon the well in accordance with the requirements in this Section and Appendix E of this Permit, unless the Permittee:

- (a) provides written notice to the Director or his/her authorized representative, prior to the two-year period;
- (b) describes actions or procedures, satisfactory to the Director or his/her authorized representative, that the Permittee will take to ensure that the well will not endanger USDWs during the period of temporary abandonment. These actions and procedures shall include compliance with the technical requirements applicable to active injection wells, unless waived by the Director or his/her authorized representative;
- (c) provides written notice to the Director or his/her authorized representative of the change in use of the well from recovery and injection to recovery only; and

- (d) receives written notice by the Director or his/her authorized representative to temporarily waive plugging and abandonment requirements.

The Permittee of a well that has been temporarily abandoned shall notify the Director prior to resuming operation of the well.

PART III. CONDITIONS APPLICABLE TO ALL PERMITS

Section A. 40 CFR 144.12 REQUIREMENTS

Injection wells authorized under this Permit shall comply with the requirements of 40 CFR § 144.12.

1. Prohibition of movement of fluids into an underground source of drinking water

No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into USDWs, if presence of that contaminant may cause a violation of any primary drinking water regulations under 40 CFR part 142 or may otherwise part adversely affect the health of persons.

2. Identification of a Violation, 40 CFR 144.12(c)

If at any time the Director learns that a Class V well may cause a violation, the Director may:

- (a) order the Permittee to take such actions (including, where required, closure of the injection well) as may be necessary to prevent the violation, or
- (b) take enforcement action.

3. Adversely Affect Human Health, 40 CFR 144.12(d)

Whenever the Director learns that a Class V well may be adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any actions prescribed in Part III. Section A.2.

Section B. CHANGES TO PERMIT CONDITIONS

1. Modification, Revocation and Reissuance, or Termination

The Director may, for cause, modify, revoke and reissue, or terminate this Permit in accordance with 40 CFR §§ 124.5, 144.12, 144.39, 144.40, and 144.41. The filing of a request for modification, revocation and reissuance, termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any condition of this Permit.

2. Conversion to Non-UIC Well

The Director may allow conversion of the well to a non-UIC well. Conversion may not proceed until the Permittee receives written approval from the Director, at which time this Permit will expire due to the end of operating life of the facility. Once expired under this part, the Permittee will need to reapply for a UIC permit and restart the complete permit process, including opportunity for public comment, before injection can occur.

Conditions of such conversion shall include approval of the proposed well rework, demonstration of mechanical integrity, and documentation that the well is authorized by another regulatory agency.

3. Transfer of Permit

Under 40 CFR § 144.38, this Permit may be transferred by the Permittee to a new owner or operator only if:

- (a) the Permit has been modified or revoked and reissued (under 40 CFR § 144.39(b)(2)), or a minor modification made (under 40 CFR § 144.41(d)), to identify the new Permittee and incorporate such other requirements as may be necessary under the SDWA, or
- (b) the Permittee provides written notification (EPA Form 7520-7) to the Director at least thirty (30) days in advance of the proposed transfer date and submits a written agreement between the existing and proposed new permittees containing a specific date for transfer or permit responsibility, coverage, and liability between them. If the Director does not notify the Permittee and the proposed new permittee of his or her intent to modify or revoke and reissue, or modify, the transfer is effective on the date specified in the written agreement. A modification under this paragraph may also be a minor modification under 40 CFR § 144.41.

4. Permittee Change of Address

Upon the Permittee's change of address, or whenever the operator changes the address where monitoring records are kept, the Permittee must provide written notice to the Director within thirty (30) days.

Section C. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this Permit shall not be affected thereby. Additionally, in a permit modification, only those conditions to be modified shall be reopened. All other aspects of the existing Permit shall remain in effect for the duration of the Permit.

Section D. CONFIDENTIALITY

In accordance with 40 CFR part 2 and 40 CFR § 144.5, information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR part 2 (Public Information). Claims of confidentiality for the following information will be denied:

- a) the name and address of the Permittee; and
- b) information which deals with the existence, absence or level of contaminants in drinking water.

Section E. ADDITIONAL PERMIT REQUIREMENTS

1. Duty to Comply

The Permittee must comply with all conditions of this Permit. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application; except that the Permittee need not comply with the provisions of this Permit to the extent and for the duration as such noncompliance is authorized in an emergency permit under 40 CFR § 144.34. All violations of the SDWA may subject the Permittee to penalties and/or criminal prosecution as specified in Section 1423 of the SDWA.

2. Need to Halt or Reduce Activity Not a Defense

The Permittee shall not use as a defense in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit.

3. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this Permit.

4. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance include effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit.

5. Permit Actions

This Permit may be modified, revoked and reissued or terminated for cause. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Property and Private Rights; Other Laws

This Permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of any other federal, state or local law or regulations.

7. Duty to Provide Information

The Permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Director, upon request, copies of records required to be kept by this Permit.

8. Inspection and Entry

The Permittee shall allow the Director, or an authorized representative, upon the presentation of credentials

and other documents as may be required by law, to:

- (a) enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;
- (b) have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;
- (c) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
- (d) sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

9. Signatory Requirements

All applications, reports or other information submitted to the Regional Administrator or his/her authorized representative shall be signed and certified according to 40 CFR § 144.32. This section explains the requirements for persons duly authorized to sign documents and provides wording for required certification.

10. Continuation of Expiring Permits

- (a) **Duty to Reapply**
If the Permittee wishes to continue an 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 this Permit expires.
- (b) **Permit Extension**
The conditions of an expired permit continue in force in accordance with 5 U.S.C. 558(c) until the effective date of a new permit, if:
 - (i) the Permittee has submitted a timely application which is a complete application for a new permit; and
 - (ii) the Director, through no fault of the Permittee, does not issue a new permit with an effective date on or before the expiration date of the previous permit.
- (c) **Enforcement**
When the Permittee is not in compliance with the conditions of the expiring or expired permit, the Regional Administrator or his/her authorized representative may choose to do any or all of the following:
 - (i) Initiate enforcement action based upon the permit which has been continued.
 - (ii) Issue a notice of intent to deny the new permit. If the permit is denied, the owner or operator would then be required to cease the activities authorized by the continued permit or be subject to enforcement action for operating without a permit.
 - (iii) Issue a new permit under 40 CFR part 124 with appropriate conditions.
 - (iv) Take other actions authorized by these regulations.

11. Reporting Requirements

Copies of all reports and notifications required by this Permit shall be signed and certified in accordance with the requirements under Part III, E.9 of this Permit and shall be submitted to EPA:

UIC Enforcement, Mail Code: 8ENF-WSD
U.S. Environmental Protection Agency
1595 Wynkoop Street
Denver, Colorado 80202-1129

All correspondence should reference the well name and location and include the EPA Permit number.

- (a) Monitoring Reports. Monitoring results shall be reported at the intervals specified elsewhere in this Permit.
- (b) Planned changes. The Permittee shall give notice to the Director as soon as possible of any planned changes, physical alterations or additions to the permitted well, and prior to commencing such changes.
- (c) Anticipated noncompliance. The Permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with Permit requirements.
- (d) Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Permit shall be submitted no later than thirty (30) calendar days following each schedule date.
- (e) Twenty-four-hour reporting. The Permittee shall report to the Director any noncompliance which may endanger human health or the environment, including:
 - (i). any monitoring or other information, which indicates that any contaminant may cause an endangerment to a USDW; or
 - (ii). any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

Information shall be provided, either directly or by leaving a message, within twenty-four (24) hours from the time the Permittee becomes aware of the circumstances by telephoning (800) 227-8917 and requesting EPA Region 8 UIC Program SDWA Enforcement Supervisor, or by contacting EPA Region 8 Emergency Operations Center at (303) 293-1788.

In addition, a follow up written report shall be provided to the Director within five (5) calendar days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

- (f) Other Noncompliance. The Permittee shall report all instances of noncompliance not reported under Paragraphs 11(a), 11(b), 11(d), or 11(e) of this Section at the time the monitoring reports are submitted. The reports shall contain the information listed in Paragraph 11(e) of this Section.
- (g) Other information. Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report

to the Director, the Permittee shall submit such facts or information to the Director within thirty (30) days of discovery of failure.

- (h) *Oil Spill and Chemical Release Reporting*. The Permittee shall comply with all reporting requirements related to the occurrence of oil spills and chemical releases by contacting the National Response Center (NRC) at (800) 424-8802 or NRC@uscg.mil.

Appendix A

WELL CONSTRUCTION REQUIREMENTS

These requirements represent the approved minimum construction standards for Wells A-1, A-5, and A-13 and all new well casing and cement well head configurations and injection tubing. Requirements for obtaining samples during and prior to well construction are described below. Descriptions for the construction of Wells A-1, A-3, and A-5 are provided below.

Casing and Cement

The well or wells shall be cased and cemented to prevent the movement of fluids into or between USDWs and shall be in accordance with 40 CFR §147.305 and the Colorado Office of the State Engineer's (SEO) Water Well Construction Rules. The Permittee must meet all applicable requirements in these Colorado Rules including Rule 10 entitled "Minimum Construction Standards for Water Wells." This Rule is designed to ensure that "...construction prevents harm to public health, will not impair water quality or cause contamination of shared groundwater resources, and will ensure the safety of groundwater resources for Colorado's existing and future populations." Rule 10 requirements include:

- (a) Rule 10.1: "General - To assist in the orderly development of the groundwater resources of Colorado, to ensure the protection of the public health, and to prevent degradation of the groundwater resource, all wells constructed to withdraw or inject water must be constructed, maintained, or repaired in such a manner that will:
 - (i). maintain existing natural protection against contamination of aquifers;
 - (ii). prevent the entry of contaminants through the borehole;
 - (iii). limit groundwater production to one aquifer unless otherwise permitted by the SEO; and
 - (iv). prevent the intermingling of groundwater from different sources through the borehole."
- (b) Rule 10.5: "Grout and Grout Placement – All wells must be grouted to prevent contaminants from entering the borehole, to separate groundwater in different aquifers, and to seal off water bearing zones known or suspected to contain contaminants".

These Rules can be found at: *Code of Colorado Regulations, Secretary of State, State of Colorado, Department of Natural Resources, Division of Water Resources, Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction, 2 CCR 402-2, Rule 10 Minimum Construction Standards for Water Wells.*

Well Construction Maintenance and Alterations

The wellbore diagrams shown below for Wells A-1, A-5 and A-13 are general representations of each well's expected construction prior to injection. As such, routine maintenance and/or minor physical alterations to constructed wells are within the scope of these wells' approved construction. Prior to beginning any such maintenance or physical alteration to an injection well's construction, the Permittee shall give advanced notice to the Director. Upon such notification by the Permittee, the Director may impose additional requirements, if necessary, to ensure USDW protection. The Permittee must continue to report, cease operations, and repair the well in accordance with conditions included in this Permit. (See Part II. Sections C.8; Section D; and Part III. Sections A and E.11)

Collection of Water Samples

Upon request water quality samples for new well requests will be collected during well construction in accordance with Part II.B.1.d of this Permit. A representative water sample from each discrete injection zone(s) shall be analyzed. After the removal of a minimum of three (3) successive pore volumes, a representative sample shall be determined by stabilized specific conductivity.

The analysis shall be submitted to the Director within sixty (60) calendar days of completion of the logging or testing activity and shall include a report describing the methods used during logging or testing and an interpretation of the log or test results.

A-1, A-5 and A-13 Well Construction

Well Name	Casing Type	Casing Material	Hole Size (in)	Casing Size (in)	Cased Interval (ft)	Cemented Interval (ft)	Screened Interval (ft)
A-1	Surface	steel	36	22	0-40	0-40	--
	Longstring	steel	20	12.75	0-1802	0-1080	1345-1760
A-5	Surface	steel	36	24	0-40	0-40	--
	Longstring	steel	unknown	12.75	0-1628	0-990	1055-1548
A-13	Surface	steel	38	30	0-40	0-40	--
	Longstring	steel	28	28	40-970	0-980	996-1498
	Longstring	steel	17.5	10.75	970-1538	--	

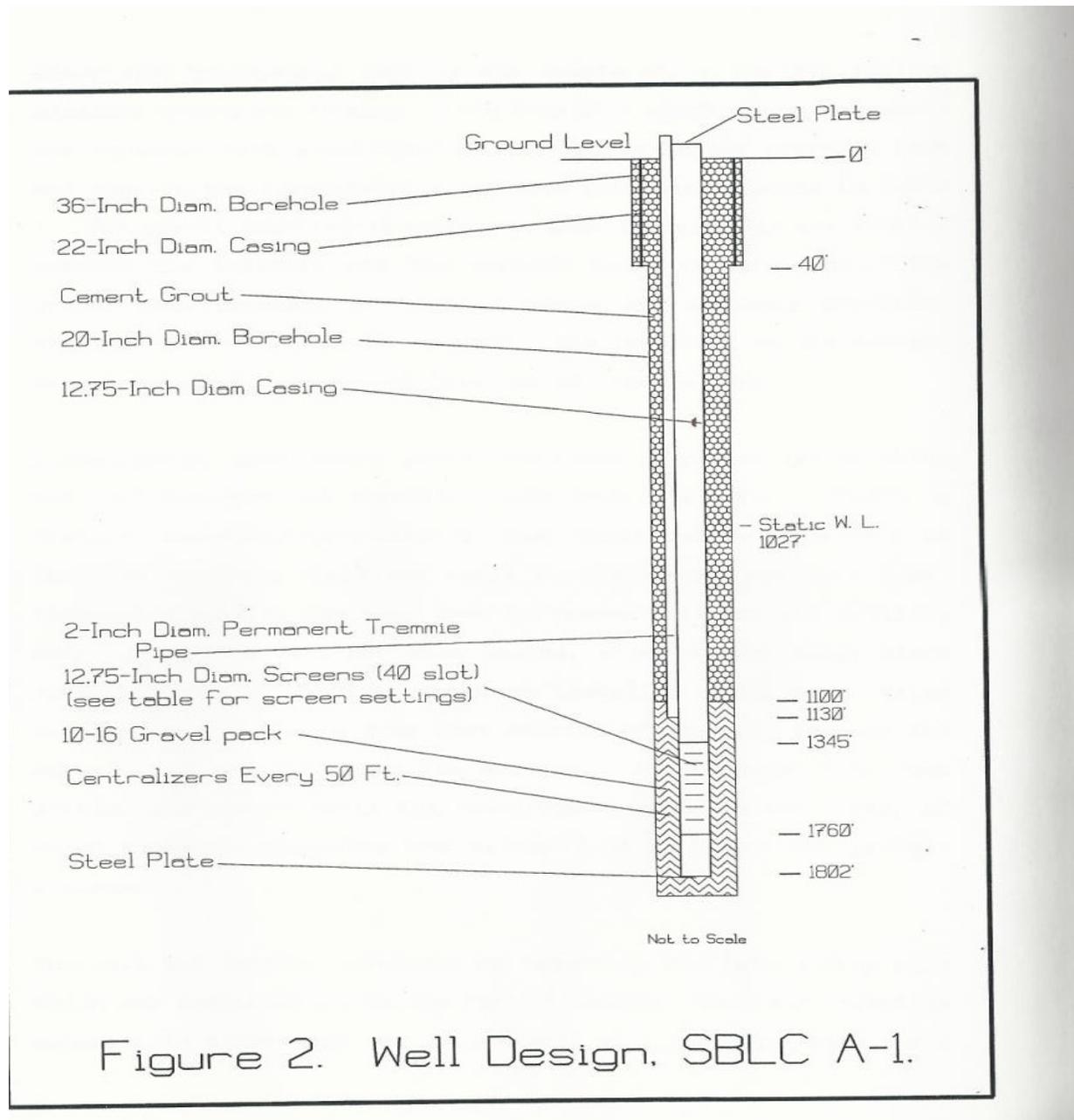
Well A-1

DWR Permit No. 44701-F, EPA 52414-11964

100 feet from the south line and 2600 feet from the west line

SE ¼ SW ¼, Section 22, Township 5 South, Range 65 West

Arapahoe County, Colorado



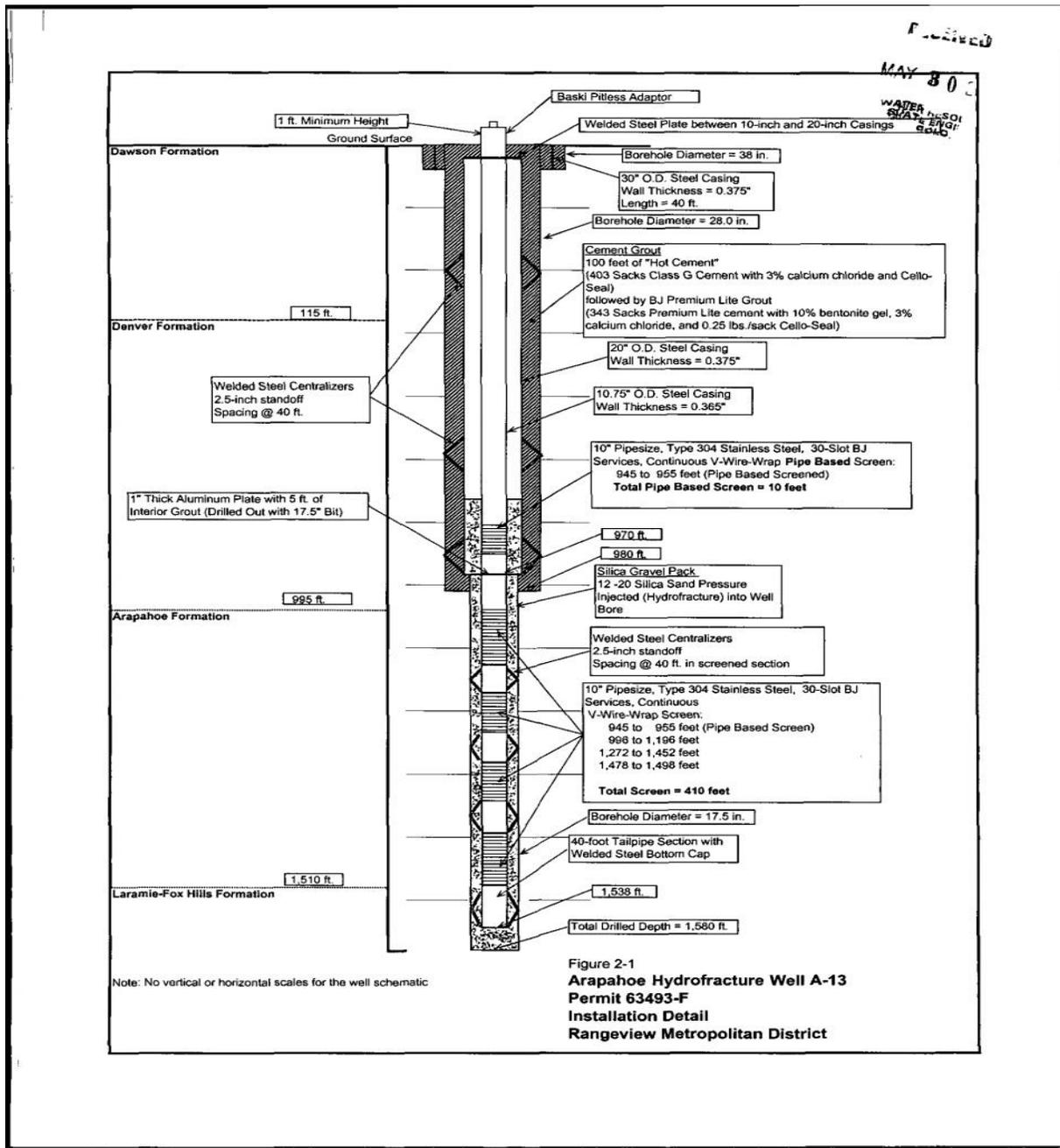
Well A-13

DWR Permit No. 63493-F, EPA 52414-12008

1360 feet from the north line and 170 feet from the west line

SW ¼ NW ¼, Section 3, Township 5 South, Range 65 West

Arapahoe County, Colorado



No well stimulation program is proposed during well completion. In the event the Permittee wishes to conduct well stimulation, the Permittee shall follow the requirements in Part II, Section B.8. *Alteration, Workover, and Well Stimulation.*

Appendix B - LOGGING AND TESTING REQUIREMENTS

Well logging and tests shall be performed according to EPA approved procedures. It is the responsibility of the Permittee to obtain and use these procedures prior to conducting any well logging or test required as a condition of this Permit.

Well logs and test results shall be submitted to the Director within sixty (60) calendar days of completion of the logging or testing activity and shall include a report describing the methods used during logging or testing and an interpretation of the log or test results. When applicable, the report shall include a descriptive report prepared by a knowledgeable log analyst, interpreting the results of that portion of those logs and tests which specifically relate to: (1) a USDW and the confining zone adjacent to it, and (2) the injection zone and adjacent formations.

LOGS AND TESTS

TYPE OF LOG OR TEST	DATE DUE
<p>Video Logs with Qualified Professional Analyst Report</p> <p>Part II Section D.2.a</p>	<p>All existing video logs shall be submitted to EPA prior to receiving authorization to inject.</p> <ul style="list-style-type: none"> - Wells A-1, A-5 and A-13 - New well(s) <p>The most recent video log for any proposed injection well shall be conducted within one year of the application submittal date.</p> <p>Run a video log following the repair of a loss of mechanical integrity and prior to authorization to recommence injection.</p> <p>All subsequent reports shall be submitted following routine maintenance activities or at least within ten years of the last video logging evaluation.</p>
<p>Baseline Water Analysis</p> <p>For the constituents found in Appendix G for new water sources proposed for injection (Part II Section C.7) and when wells are added to the Permit (Part II Section B.1(d))</p>	<p>Collect a representative fluid sample of proposed new injectate (treated water source) near the injection point and prior to receiving authorization to inject.</p> <p>Prior to receiving authorization to inject, collect a representative fluid sample of the formation water from the proposed new well(s) or submit a statement that the water sample will be obtained during well construction/conversion and submitted in accordance with Appendix A.</p>

<p>Cyanide</p>	<p>Collect a representative injectate fluid sample and analyze for cyanide prior to receiving authorization to inject.</p>
<p>Pipe analysis log or Caliper Log To check the condition of the casing of an existing well to be converted to an ASR well</p>	<p>Prior to receiving authorization to inject. Run during well conversion activities. - Wells A-1, A-5 and A-13 - New well(s)</p>
<p>Cement Records and/or Cement Bond Logs For injection and AOR wells not previously evaluated for Part II MI Demonstration (Part II Section E.2(b))</p>	<p>- When requesting authorization of additional wells. - When requesting an extension to construct/convert a well, if not previously provided.</p>
<p>Bench Scale Water Chemistry Follow procedures in Appendix H (Part II Sections B and D.7 (a)(iii))</p>	<p>Perform tests following Authorization to Inject: - New well - New water source</p>
<p>Pilot Cycle Tests Follow procedures in Appendix I Analyze for constituents found in Appendix J (Part II Sections B and D.7 (a)(iii))</p>	<p>Perform tests following Authorization to Inject: - New well - New water source (upon request from the Director only)</p>

Appendix C - OPERATING REQUIREMENTS

INJECTION ZONE:

Injection is permitted only within the approved injection zone listed below.

APPROVED INJECTION ZONE (GL, ft.)

WELL NAME	FORMATION NAME OR STRATIGRAPHIC UNIT	TOP (FT.)*	BOTTOM (FT.) *
A-1	Arapahoe	1345	1760
A-5	Arapahoe	1055	1548
A-13	Arapahoe	996	1498

*top and bottom depths of screens

MAXIMUM INJECTION VOLUME:

There is no limitation on the fluid volume permitted to be injected into this well at this time. In no case shall injection pressure exceed the MAIP.

MAXIMUM INJECTION PRESSURE:

Maximum Allowable Injection Pressure (MAIP) as measured at the surface shall not exceed the pressure(s) listed below:

- Wells A-1, A-5 and A-13 and all added wells
- MAIP: 133 psig or an alternate approved pressure by the Director.

Appendix D - MONITORING, AND REPORTING PARAMETERS

This is a listing of the parameters required to be observed, recorded, and reported. Refer to the Part II, Section D and F of the Permit, for detailed requirements for observing, recording, and reporting of these parameters once baseline samples have been taken for constituents in Appendix G. All water quality samples shall be taken from a sampling port location that ensures the samples are representative of the injected/recovered water.

EPA Form 7520-8 or 7520-11 may be used or adapted to submit the Annual Report, however, the monitoring requirements specified in this Permit are mandatory even if EPA Form 7520-11 indicates otherwise. An electronic form may also be obtained from EPA to satisfy reporting requirements.

OBSERVE WEEKLY AND RECORD MONTHLY
<ul style="list-style-type: none">● Cumulative fluid volume injected (since injection began) in gallons;● Cumulative fluid volume recovered (since injection began) in gallons;● Injection Pressure (measured at the pump house) versus Wellhead Injection Pressure*● Injection Rate in gallons per minute (gpm) or gallons per day (gpd) Note: measured near the point of injection● Injection Volume in gallons● Injected and Recovery Volume in gallons● Recovery Rate in gpm or gpd Note: measured near the point of injection● Wellhead Injection Pressure (psig)

*Note: Injection pressure is the pressure which is exerted at the pump house or location where fluids are stored (i.e. storage tanks) prior to reaching the well. Wellhead injection pressure is the pressure exerted on the wellhead to place fluids into the subsurface.

QUARTERLY SAMPLING & ANALYSIS	
NITROSAMINE EVALUATIONS	<p>Obtain and analyze injectate and recovered water for nitrosamines on a quarterly (i.e., every 90 days) basis for the duration of this Permit. This analysis may be coordinated with other sampling requirements. (e.g. peak flow sampling and annual analysis).</p> <p>Note: Obtain one of the samples for the injectate at the tap at the wellhead and analyze injectate for nitrosamines during the month where flows from surface water sources are at their maximum level. The peak month shall be determined by evaluating three years of monthly recovery rates at the supplying water systems.</p>

QUARTERLY REPORTING	
CUMULATIVE FLUID VOLUME	Monthly cumulative injected and recovered fluid to date (gallons).
INJECTION FLOW RATE	Monthly average, maximum, minimum values for injection pressure measured near the wellhead (gpm or gpd).
INJECTION PRESSURE (measured from the Pump House)	Monthly average, maximum, minimum values for injection pressure measured at the pump house (psig).
INJECTION VOLUME	Monthly average, maximum, minimum values for injection volume measured near the wellhead (gallons).
RECOVERY VOLUME	Monthly average, maximum, minimum values for recovery volume measured near the wellhead (gallons).
SAMPLING RESULTS	The results of any quarterly (i.e., every 90 days) sampling analysis obtained for the injectate and/or recovered waters, including for nitrosamines, elevated constituents from new wells or water sources, and any other constituents required by the Director*.
WELLHEAD PRESSURE	Monthly average, maximum, minimum values for injection pressure measured near the wellhead. (psig)

ANNUAL SAMPLING & ANALYSIS	
INJECTATE	Obtain and analyze injectate on an annual basis using the

	parameter list in Appendix J.
RECOVERED WATER	Obtain and analyze recovered water from each recovery well on an annual basis using the parameter list in Appendix J.

ANNUAL REPORTING	
FLUID ANALYSIS	Written results of annual injected fluid analysis.
IDENTIFICATION OF ALL SOURCES	Sources of all fluids injected during the year, including any wellfield and formation, noting any major changes in characteristics of injected fluid.

In addition to these items, additional logging and testing results may be required periodically. For a list of those items and their due dates, please refer to Appendix B – LOGGING AND TESTING REQUIREMENTS.

Appendix E - PLUGGING AND ABANDONMENT (P&A) REQUIREMENTS

All wells shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids either into or between USDWs in accordance with 40 CFR § 146.10. Additional federal, state or local law or regulations may also apply.

Appendix F - CORRECTIVE ACTION PLAN

No corrective action is required at this time as EPA's evaluation did not identify migration pathways within the area of review.

Appendix G - ASR BASELINE CONSTITUENT LIST

Appendix G contains a list of constituents to be analyzed for baseline evaluations, and the Permit Limit for each contaminant. Injection activities will not be authorized if a contaminant exceeds a Permit Limit. This list shall also be used to analyze the injectate whenever a new water source is added and/or to analyze the formation water whenever a new well is authorized under this Permit. All analytical testing must be done in a state-certified laboratory.

AQUIFER STORAGE AND RECOVERY PROJECTS

List of constituents to be analyzed for baseline evaluations:

General

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
pH	6.5 – 8.5	secondary	150.1
Electricity Conductivity			SM 2510B, 120.1
Total Dissolved Solids	500	secondary	
Total Organic Carbon			
Alkalinity, Total	mg/L as CaCO ₃	0.006	

Metals

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Aluminum	200 ug/L		
Antimony	0.006	MCL	EPA 200.8, 200.9
Arsenic	0.01	MCL	EPA 200.7, 200.8, 200.9
Barium	2	MCL	EPA 200.7, 200.8
Beryllium	0.004	MCL	EPA 200.7, 200.8, 200.9
Boron	6	HA-Lifetime	EPA 200.7, 212.3
Cadmium	0.005	MCL	EPA 200.7, 200.8, 200.9
Calcium			
Chromium (total)	0.1	MCL	EPA 200.7, 200.8, 200.9

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Copper	1.3	MCL-TT	EPA 200.7, 200.8, 200.9
Iron	5	Region 8 Permit Limit	EPA 200.7, 200.9
Lead	0.015	MCL-TT	EPA 200.8, 200.9
Manganese	0.3	HA-Lifetime	EPA 200.7, 200.8, 200.9
Magnesium			
Mercury (inorganic)	0.002	MCL	EPA 245.1, 245.2, 200.8
Molybdenum	0.04	HA-Lifetime	EPA 200.7, 246.1, 246.2
Nickel	0.1	HA-Lifetime	EPA 200.7, 200.8, 200.9
Potassium			
Selenium	0.05	MCL	EPA 200.8, 200.9
Silver	0.1	HA-Lifetime	EPA 200.7, 200.8, 200.9
Sodium			
Strontium	4	HA-Lifetime	EPA 272.1, 272.2, 200.7
Thallium	0.002	MCL	EPA 200.8, 200.9
Zinc	2	HA-Lifetime	EPA 200.7, 200.8

Inorganics

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Ammonia	30 mg/L	HA-Lifetime	EPA 350.1, 350.2, 350.3
Asbestos (fibers/1>10µm in length)	7 million fibers/L	MCL	EPA 100.1,100.2
Bicarbonate			SM 2330B
Carbonate			SM 2330B

Chloride	250	secondary	
*Cyanide	0.2 mg/L	MCL	EPA 335.4
Fluoride	4 mg/L	MCL	EPA 300.0
Nitrate (as N)	10 mg/L	MCL	EPA 300.0
Nitrate-Nitrite (both as N)	10 mg/L	MCL	EPA 300.0
Nitrite (as N)	1 mg/L	MCL	EPA 300.0
Sulfate	250	secondary	

* If cyanide is detected in the source water and not alkalinized (pH less than 8.5), the Permittee must remove the cyanide from the source water prior to any chloramination.

Radionuclides

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Radium 226 & 228 combined	5 pCi/L	MCL	Standard Method 304
Gross alpha particle activity (exc.Ra-226, radon, and uranium)	15 pCi/L	MCL	EPA 900.0
Uranium	0.03	MCL	EPA 908.0, 908.1

Volatile Organics using EPA Method 524.2 or 8260

Parameter Name	CAS No	Regulatory Limit (mg/L)	Standard Type
1,1,1,2-Tetrachloroethane	630-20-6	0.07	HA-Lifetime
1,1,1-Trichloroethane	71-55-6	0.2	MCL
1,1,2,2-Tetrachloroethane	79-34-5	0.04	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
1,1,2-Trichloroethane	79-00-5	0.005	MCL
1,1-Dichloroethylene	75-35-4	0.007	MCL

Parameter Name	CAS No	Regulatory Limit (mg/L)	Standard Type
1,2-(cis)Dichloroethylene	156-59-2	0.07	MCL
1,2-(trans)Dichloroethylene	156-60-5	0.1	MCL
1,2,3-Trichloropropane	96-18-4	0.02	Region 8 Permit Limit
1,2,4-Trichlorobenzene	120-82-1	0.07	MCL
1,2-Dibromomethane (Ethylene Dibromide EDB)	106-93-4	0.00005	MCL
1,2-Dichlorobenzene o-	95-50-1	0.6	MCL
1,2-Dichloroethane	107-06-2	0.005	MCL
1,2-Dichloropropane	78-87-5	0.005	MCL
1,3-Dichlorobenzene m-	541-73-1	0.6	HA-Lifetime
1,4-Dichlorobenzene p-	106-46-7	0.075	MCL
2-Chlorotoluene (o-)	95-49-8	0.1	HA-Lifetime
4-Chlorotoluene (p-)	106-43-4	0.1	HA-Lifetime
Acetone	67-64-1	6	Region 8 Permit Limit
Acrylonitrile	107-13-1	0.006	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
Benzene	71-43-2	0.005	MCL
Bromobenzene	108-86-1	0.06	HA-Lifetime
Bromochloromethane	74-97-5	0.09	HA-Lifetime
Bromodichloromethane (THM)	75-27-4	0.02	Region 8 Permit Limit
Bromoform (THM)	75-25-2	0.2	Region 8 Permit Limit
Bromomethane	74-83-9	0.01	HA-Lifetime
Carbon tetrachloride	56-23-5	0.005	MCL
Chlorobenzene (Monochlorobenzene)	108-90-7	0.1	MCL
Chlorodibromomethane Dibromochloromethane)(THM)	124-48-1	0.06	HA-Lifetime

Parameter Name	CAS No	Regulatory Limit (mg/L)	Standard Type
Chloroform (THM)	67-66-3	0.07	HA-Lifetime
Chloromethane	74-87-3	0.4	10-day HA for a 10 kg child
Dichlorodifluoromethane	75-71-8	1	HA-Lifetime
Dichloromethane (Methylene chloride)	75-09-2	0.005	MCL
Ethylbenzene	100-41-4	0.7	MCL
Hexachlorobutadiene	87-68-3	0.002	Region 8 Permit Limit
Hexachloroethane	67-72-1	0.001	HA-Lifetime
Isopropylbenzene (cumene)	98-82-8	0.8	Region 8 Permit Limit
Methyl Ethyl Ketone	78-93-3	4	HA-Lifetime
Naphthalene	91-20-3	0.1	HA-Lifetime
Perchloroethylene (PCE)(Tetrachloroethylene)	127-18-4	0.005	MCL
Styrene	100-42-5	0.1	MCL
Toluene	108-88-3	1	MCL
Total Trihalomethanes		0.08	MCL
Trichloroethylene (TCE)	79-01-6	0.005	MCL
Trichlorofluoromethane	75-69-4	2	HA-Lifetime
Vinyl chloride	75-01-4	0.002	MCL
Total Xylenes	1330-20-7	10	MCL

Semi-volatile Organics using EPA Method 525.2 or 8270

Parameter Name	CAS No	Regulatory Limit (mg/l) or specified unit	Standard Type
1,2,4-Trichlorobenzene	120-82-1	0.07	MCL

Parameter Name	CAS No	Regulatory Limit (mg/l) or specified unit	Standard Type
1,2-Dichlorobenzene	95-50-1	0.6	MCL
1,3-Dichlorobenzene	541-73-1	0.6	HAL
1,4-Dichlorobenzene	106-46-7	0.075	MCL
2,4,6-Trichlorophenol	88-06-2	0.002	Region 8 Permit Limit
2,4-Dichlorophenol	120-83-2	0.02	HA-Lifetime
2,4-Dinitrotoluene	121-14-2	0.005	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
2,6-Dinitrotoluene	606-20-2	0.005	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
2-Chlorophenol	95-57-8	0.04	HA-Lifetime
4-Nitrophenol	100-02-7	0.06	HA-Lifetime
Acenaphthene	83-32-9	0.4	Region 8 Permit Limit
Aldrin	309-00-2	0.0002	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
Anthracene	120-12-7	2	Region 8 Permit Limit
Benzo(a)pyrene	50-32-8	0.0002	MCL
bis(2-Ethylhexyl) phthalate	117-81-7	0.006	MCL
Butyl benzyl phthalate	85-68-7	1	Region 8 Permit Limit
Chlordane	57-74-9	0.002	MCL
Dieldrin	60-57-1	0.0002	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk
Diethyl phthalate	84-66-2	6	Region 8 Permit Limit
Di-n-butyl phthalate	84-74-2	0.8	Region 8 Permit Limit
Endrin	72-20-8	0.002	MCL
Fluorene	86-73-7	0.2	Region 8 Permit Limit
Heptachlor	76-44-8	0.0004	MCL

Parameter Name	CAS No	Regulatory Limit (mg/l) or specified unit	Standard Type
Heptachlor epoxide	1024-57-3	0.0002	MCL
Hexachlorobenzene	118-74-1	0.001	MCL
Hexachlorobutadiene	87-68-3	0.002	Region 8 Permit Limit
Hexachlorocyclopentadiene	77-47-4	0.05	MCL
Hexachloroethane	67-72-1	0.001	HA-Lifetime
Isophorone	78-59-1	0.1	HA-Lifetime
Lindane	58-89-9	0.0002	MCL
Naphthalene	91-20-3	0.1	HA-Lifetime
Pentachlorophenol	87-86-5	0.001	MCL
Phenol	108-95-2	2	HA-Lifetime
Pyrene	129-00-0	0.2	Region 8 Permit Limit
Toxaphene	8001-35-2	0.003	MCL

Pesticides and Herbicides

Parameter Name	CAS No	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Alachlor	15972-60-8	0.002	MCL	EPA 505, 507, 525
Aldicarb	116-06-03	0.003	MCL	EPA 531.1
Aldicarb sulfone	1646-87-4	0.002	MCL	EPA 531.1
Aldicarb sulfoxide	1646-87-3	0.004	MCL	EPA 531.1
Aldrin	309-00-2	0.0002	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk	EPA 505, 508

Parameter Name	CAS No	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Ametryn	834-12-8	0.06	HA-Lifetime	EPA 507
Atrazine	1912-24-9	0.003	MCL	EPA 505, 507
Bromacil	314-40-9	0.07	HA-Lifetime	EPA 507
Butylate	2008-41-5	0.4	HA-Lifetime	EPA 507
Carbaryl	63-25-2	0.08	Region 8 Permit Limit	EPA 531.1
Carbofuran	1563-66-2	0.04	MCL	EPA 531.1
Carboxin	5234-68-4	0.7	HA-Lifetime	EPA 507
Chlordane	57-74-9	0.002	MCL	EPA 505, 508, 525
Chlorothalonil	1897-45-6	0.1	Region 8 Permit Limit	EPA 508
DCPA (Dactyl)	1861-32-1	0.07	HA-Lifetime	EPA 508
Diazinon	333-41-5	0.001	HA-Lifetime	EPA 507
Dieldrin	60-57-1	0.0002	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk	EPA 505, 508
Diphenamid	957-51-7	0.2	HA-Lifetime	EPA 507
Disulfoton	298-04-4	0.0007	HA-Lifetime	EPA 507
Endrin	72-20-8	0.002	MCL	EPA 505, 508, 525.1
Fenamiphos	22224-92-6	0.0007	HA-Lifetime	EPA 507
Heptachlor	76-44-8	0.0004	MCL	EPA 505, 508
Heptachlor epoxide	1024-57-3	0.0002	MCL	EPA 505, 508
Hexachlorobenzene	118-74-1	0.001	MCL	EPA 505, 508, 525.1
Hexachlorocyclopentadiene	77-47-4	0.05	MCL	EPA 505, 525.1
Hexazinone	51235-04-2	0.4	HA-Lifetime	EPA 507
Lindane	58-89-9	0.0002	MCL	EPA 505, 508
Methomyl	16752-77-5	0.2	HA-Lifetime	EPA 531.1

Parameter Name	CAS No	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Methoxychlor	72-43-5	0.04	MCL	EPA 505, 508, 525
Metolachlor	51218-45-2	0.7	HA-Lifetime	EPA 507
Metribuzin	21087-64-9	0.07	HA-Lifetime	EPA 507
Oxamyl (Vydate)	23135-22-0	0.007	MCL	EPA 531.1
Prometon	1610-18-0	0.4	HA-Lifetime	EPA 507
Pronamide	23950-58-5	0.1	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk	EPA 507
Propachlor	1918-16-7	0.1	Region 8 Permit Limit 10 ⁻⁴ Cancer Risk	EPA 508
Propazine	139-40-2	0.01	HA-Lifetime	EPA 507
Simazine	122-34-9	0.004	MCL	EPA 505, 507, 525.1
Tebuthiuron	34014-18-1	0.5	HA-Lifetime	EPA 507
Terbacil	5902-51-2	0.09	HA-Lifetime	EPA 507
Terbufos	13071-79-9	0.0004	HA-Lifetime	EPA 507
Trifluralin	1582-09-8	0.01	HA-Lifetime	EPA 508

Disinfectants and Disinfection Byproducts

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Method
Bromate	0.01	MCL	EPA 317.0, Revision 2 321.8, 326.0
Chloramine (as free chlorine)	4	MCL	
Chlorine (free chlorine, combined)	4	MCL	Standard Methods 20 th edition: 4500-C1 D 4500-C1 F 4500-C1 G

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Method
			4500-C1 H
Chlorine dioxide	0.8	MCL	EPA 327, Revision 1 Standard Method 20 th edition: 4500-ClO ₂ D 4500-CLO ₂ E
Chlorite	1.0	MCL	EPA 300.0, 300.1
Total Haloacetic Acids (HAA5s) Bromoacetic acid Dibromoacetic acid Dichloroacetic acid Monochloroacetic acid Trichloroacetic acid	0.06	MCL	EPA 552.3
Total Trihalomethanes (TTHMs) Chloroform Bromodichloromethane Dibromochloromethane Bromoform	0.08	MCL	EPA 502.2, 524.2
N-nitroso-dimethylamine (NDMA)	NA		EPA 521
N-nitroso-diethylamine (NDEA)	NA		EPA 521
N-nitroso-di-n-butylamine (NDBA)	NA		EPA 521
N-nitroso-di-n-propylamine (NDPA)	NA		EPA 521
N-nitroso-methylethylamine (NMEA)	NA		EPA 521
N-nitroso-pyrrolidine (NPYR)	NA		EPA 521

MCL: Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

MCLG: Maximum Contaminant Level Goal. A non-enforceable health goal which is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.

TT: Treatment Technique. A required process intended to reduce the level of a contaminant in drinking water.

HA: Health Advisory. An estimate of acceptable drinking water levels for a chemical substance based on health effects information; a Health Advisory is not a legally enforceable Federal standard, but serves as technical guidance to assist Federal, State, and local officials.

HA-Lifetime: The concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for a lifetime of exposure. The Lifetime HA is based on exposure of a 70-kg adult consuming 2 liters of water per day. The Lifetime HA for Group C carcinogens includes an adjustment for possible carcinogenicity.

Region 8 Permit Limit: Permit limit calculated by Region 8 Drinking Water Toxicologist based on human health criteria.

10⁻⁴ Cancer Risk: The concentration of a chemical in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 10,000

HA-Ten Day: The concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for up to ten days of exposure for a 10 kg child consuming 1 liter per day.

Appendix H - BENCH SCALE WATER CHEMISTRY TEST PROCEDURES FOR NITROSAMINES

This Appendix provides a procedure for implementing a bench scale water chemistry test for the Permittee's ASR Project. The Bench Scale Water Chemistry test will be used to help predict any changes that may occur in the injectate chemistry over time. The procedure will be performed for the Permittee's addition of wells that are authorized under this Permit. The Director also requires that this test be performed for a new water source. This test may be performed in parallel to pilot cycle testing and/or operational use of the well due to the potential duration of this test.

Samples for the test shall be obtained prior to performing the Pilot Cycle Test. Testing of water chemistry shall be performed on the injectate and recovered formation water. Prior to the start of testing, a detailed sampling protocol shall be obtained from the contract laboratory. This protocol shall include a written description of sampling methods for use by field personnel and for inclusion in reporting to the Colorado State Engineers Office and EPA. Sampling shall adhere to protocols as specified by the water quality testing laboratory for sampling methods, sample preservation, sample handling times, and chain-of-custody records.

Section A. Analysis of the Formation Water

The Permittee shall arrange for analytical data prepared by the laboratory to be submitted to them and EPA, simultaneously.

Prior to performing the Part I MI and Pilot Cycle Test, The Permittee shall collect four samples of sufficient size to meet the requirements for testing of the formation water from each of the proposed ASR wells. These samples shall be obtained using the volatile organic carbon (VOC) collection method and stored on a shelf at the temperature recorded for the recovered water until analyzed. The VOC collection method requires field staff to fill the bottle to the maximum level and exclude all air pockets to the extent possible. The laboratory will provide bottles without septa caps for sample collection according to the method and lab Standard Operating Procedure (S.O.P). According to lab protocol, air pockets in samples are acceptable if < 6 mm.

1. These samples shall be "spiked" by the laboratory with a quantity of 10 ng/L of N-nitrosodimethylamine NDMA and 10 ng/L of N-nitroso-di-n-butylamine (NDBA). The purpose of this shelf test is to observe how NDMA and NDBA react with the native formation water. The sample bottles should be stored in a fashion that prevents light degradation.

2. Ninety (90) days following the collection of the formation samples, one sample bottle shall be analyzed for NDMA and NDBA. This analytical process shall be repeated for the next bottles on a quarterly (i.e., every 90 days) basis. The analytical results of NDMA and NDBA concentrations shall be reported to the Director within thirty (30) days.

Section B. Analysis of the Injectate Water

The Permittee shall arrange for analytical data prepared by the laboratory to be submitted to them and EPA, simultaneously.

1. Collect five samples of a volume needed to meet the requirements of the injectate testing on the same day within thirty (30) days following the start of the Pilot Cycle Test. These samples shall be obtained using the VOC collection method. Analyze the first sample for NDMA and NDBA.
2. Store the other four samples on a shelf at formation temperatures until analyzed. The sample bottles should be stored in a dark location away from light to prevent premature breakdown.
3. Ninety (90) days following the collection of the injectate samples, one sample bottle shall be analyzed for NDMA and NDBA. Repeat this analytical process for the next sampling bottles on a quarterly (i.e., every 90 days) basis. The analytical results of NDMA and NDBA concentrations shall be reported to the Director within thirty (30) days.

Appendix I - ASR PILOT CYCLE TEST PROCEDURES

This Appendix provides procedures for pilot cycle testing of The Permittee's addition of new wells for sampling and analysis of constituents listed below and in Appendix J. This test may also be used when adding a new water source upon receipt of written notification from the Director. The intent of this procedure is to be responsive to conditions existing at the time of the pilot testing. For example, while this protocol defines one of the test cycles as a 7-day cycle (7 days of recharge/7 days of recovery), a change in the Permittee's supply or demand during the cycle may require a delay in operations to achieve the minimum recharge or recovery time frame. This test will be used to predict any potential impacts which could occur as a result of injection activities.

Additionally, since recovery rates vary from injection rates, as required by the State of Colorado, these time periods will not be the same. If there are significant changes between successive sampling events, it may be appropriate to increase sampling frequency and/or parameters.

Sampling shall adhere to protocols as specified by the water quality testing laboratory for sampling methods, sample preservation, sample handling times, and chain-of-custody records.

Section A. Measurements, Instrumentation and Monitoring

The following conditions will be measured and recorded in advance of and during each round of cycle testing:

1. Static water levels (between cycles)
2. Water levels while pumping
3. Water levels while injecting or specify surface, if applicable
4. Flow rate and cumulative amount pumped while recovering, by cycle and total
5. Flow rate and cumulative amount stored while injecting, by cycle and total
6. Flow rate entering and exiting the system
7. Pressure data collected at the wellhead
8. Inflation pressure on flow control valve (FCV), pressure data collected from the pump or in the pipeline.
9. Intermittent sampling as described in the application for measurement of total organic carbon and dissolved oxygen in injectate and recovered water
10. Start/stop times and elapsed time for cycles
11. Sampling dates and sample testing protocol

Measurements 1-11 listed above in Section A will be communicated via the Permittee's SCADA system to the control facility, where the data will be processed and archived. Measurements of wellhead pressure (item 7) will be made and recorded manually on a weekly schedule, depending on the consistency of line pressure.

The following measurements will be made and recorded after cycle testing:

1. Static water levels (between pumping periods)
2. Water levels while pumping
3. Flow rate and cumulative amount pumped while pumping and total
4. Flow rate entering and exiting the system
5. Line pressure (at the wellhead)

6. Inflation pressure on FCV
7. Nitrogen tank pressure (if present)

Section B. Cycle Testing

The applicant shall obtain an injectate sample prior to starting cycle testing if there has been a change in the water chemistry from the baseline sampling previously provide to EPA. Cycle testing will consist of progressively longer periods during which water is injected, stored, and then recovered. For purposes of this Permit, one cycle consists of one period of injection, followed by storage, followed by recovery.

The cycle testing will occur according to the following schedule:

Schedule for Cycle Testing				
Cycle No.	Injection Time (days)	Storage Time (days)	Recovery Time (days)	Comments
1	3	1	3	Optimization work to be performed during implementation of Cycle 1
2	7	7	7	
3	14	14	14	
4	21	21	21	
Alternate	45	45 - 60	45	Alternative
Cycle 4 (optional Cycle 4 test)				Cycle 4 test

1. Storage Time

The storage times presented above are the minimum duration that fluids must be maintained in storage. This time may be increased at the Permittee’s discretion.

2. Recovery Time

The recovery times presented above are estimates. The times shall be adjusted so that: 1) recovery continues until native source water is encountered; and 2) the volume previously injected is recovered considering recovery occurs at a higher rate than injection.

3. Additional cycles may be added as needed

(a) *Analysis/or Cycle 1 for Recovered Water*

Cycle 1 shall be performed to optimize the equipment for testing. Field measurements shall include temperature, pH, TDS, electrical conductivity, dissolved oxygen, and oxidation-reduction potential (ORP);

(b) Analysis for Cycles 2 through 4 for Recovered Water

- (i). Collect data sets during Cycles 2 through 4 and any additional cycling events at the beginning, mid-stream, and end of recovery for each cycle to monitor and record the pH, TDS, dissolved oxygen, ORP, and electrical conductivity;
- (ii). Evaluate indicator results in item (i) above to determine the potential timeframe (or recovered water volume point) in which the transition from injectate to native formation water can be detected based on the water chemistry of injected fluids during each cycle; and
- (iii). Collect a water sample after recovering between 80% - 90% of the injected volume for Cycles 2 – 4 and analyze for Appendix J parameters. Collect a sample of the injectate water (“bubble fringe”) prior to the transition into the native water by considering the findings in item (ii) above.

4. Final Report

- (a) Prepare a summary report for each cycle for the implementation and findings observed during the implementation of the Pilot Cycle Test. Include a copy of the analytical data collected during the Pilot Cycle Test in this report. This report shall summarize the analysis and discuss the potential for future injection activities to result in changes in groundwater chemistry.
- (b) All submitted laboratory data shall include EPA' s regulatory limits (maximum contaminant levels, Region 8 limits, health advisory limits). All values which exceed the regulatory limits shall be highlighted.
- (c) This report shall be submitted to the Director within thirty (30) calendar days from the completion of all test procedures and receipt of all analytical results from the last cycle conducted.

Appendix J - CONSTITUENT LIST FOR PILOT CYCLE TEST ANALYSIS & ONGOING MONITORING REQUIREMENTS

Appendix J requires collection of water quality data for the constituents listed below following the procedures in Appendix I for Pilot Cycle Testing. This constituent list shall also be used to collect water quality data for ongoing monitoring requirements presented in Appendix D. All analytical testing must be done in a state certified laboratory to ensure that permit limits can be met. However, other constituents may be added by written response from the Director through email or letter following the review of baseline data collected with the constituent list presented in Appendix G and/or if there is a need to evaluate a new constituent(s). Any new constituent added to the list of constituents in Appendix J shall be evaluated following the procedures in Appendix I and/or review of monitoring results in Appendix D.

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Detection Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
pH	6.5 - 8.5		Secondary	150.1
Specific Gravity				
Temperature				
Electricity Conductivity				M2510B, 120.1
Total Dissolved Solids	500		Secondary	
<i>ANIONS</i>				
Carbonate				SM 2330B
Chloride	250		Secondary	
Nitrate (as N)	10		MCL	353.2
Nitrite (as N)	1		MCL	353.2
Nitrate-Nitrite				
Bicarbonate				SM 2330B
Sulfate	250		Secondary	
Fluoride	4		MCL	SM 4500-F C
<i>CATIONS</i>				
Calcium				
Magnesium				

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Detection Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Potassium				
Sodium				
<i>METALS</i>				
Antimony	0.006	0.003	MCL	200.8, 200.9
Arsenic	0.01	0.005	MCL	200.7, 200.8,200.9
Barium	2	1	MCL	200.7, 200.8
Beryllium	0.004	0.002	MCL	200.7,200.8, 200.9
Boron	6	0.7	HA-Lifetime	200.7, 212.3
Cadmium	0.005	0.0025	MCL	200.7, 200.8, 200.9
Chromium	0.1	0.05	MCL	200.7, 200.8, 200.9
Copper	1.3	0.65	MCL-TT	200.7, 200.8, 200.9
Total Iron	5	2.5	Region 8 Permit Limit	200.7, 200.9
Lead	0.015	0.0075	MCL-TT	200.8, 200.9
Manganese	0.3	0.4	HA-Lifetime	200.7, 200.8,200.9
Mercury (inorganic)	0.002	0.001	MCL	245.1, 245.2,200.8
Molybdenum	0.04	0.02	HA-Lifetime	200.7, 246.1,246.2
Nickel	0.1	0.05	HA-Lifetime	200.7, 200.8,200.9
Selenium	0.05	0.025	MCL	200.8, 200.9
Silver	0.1	0.05	HA-Lifetime	200.7, 200.8,200.9
Strontium	4	2	HA-Lifetime	272.1, 272.2,200.7
Thallium	0.002	0.001	MCL	200.8, 200.9
Zinc	2	1	HA-Lifetime	200.7, 200.8
Uranium	0.003			908.0, 908.1
Gross Alpha	15 pCi/L			900
Radium 226 & 228 combined	5 pCi/L			304

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Detection Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Aluminum	0.05 to 0.2		Secondary	
Total Trihalomethanes	0.08		MCL	502.2, 524.2
Turbidity	TT			
Total Haloacetic acid (HAA5s)	0.06		MCL	552.2
Coliforms	5.0%			
N-nitroso-dimethylamine (NDMA)		2 ng/L		521
N-nitroso-di-n-butylamine (NDBA)		6 ng/L		521