



Memorandum

To: Adam Jokerst, PE, City of Greeley
From: Joel Barber, PE
Reviewed by: Cortney Brand, PG
Date: February 10, 2021
Project: 1229GRE20
Subject: Terry Ranch Groundwater Contamination Risk Assessment

Introduction

The purpose of this memorandum is to address concerns raised regarding the vulnerability of Terry Ranch groundwater to contamination. Specific concerns include the potential for groundwater contamination from oil and gas development, mining, roadways, railways, the Atlas D Missile Site 4, and Fort Collins' Meadow Springs Ranch biosolids disposal facility. This memo characterizes these potential groundwater contamination risks and assesses the aquifer's vulnerability. We also present due diligence studies of reported groundwater contamination in the general vicinity of Terry Ranch, discuss how the aquifer is inherently protected from surface activities, and provide recommendations for mitigation that can be implemented to protect groundwater quality.

Terry Ranch Groundwater Vulnerability Assessment

Deep bedrock aquifers, such as the Upper Laramie Aquifer underlying Terry Ranch, are much less vulnerable to surface contamination than shallow, alluvial aquifers and surface water bodies. Deep bedrock aquifers are protected from surface contaminants by the overlying unsaturated (vadose) zone and geologic confining layers, which impede the downward migration of contaminants from the surface into groundwater.

The White River Formation (WRF) overlies the Upper Laramie Aquifer in the northern portion of Terry Ranch. The Brule Member of the WRF is composed of 165 to 300 feet of low-permeability silty clays, clayey silts, siltstone, and claystone that function as an aquitard (Final Area RI 2019). A surface contaminant that enters the vadose zone in this area would likely terminate at the top of the Brule Formation and not migrate into the Upper Laramie Aquifer. If a contaminant were to enter the Upper Laramie Aquifer, it would move very slowly, providing Greeley time to respond before its production wells were impacted. LRE estimates that the average linear velocity of groundwater in the Upper

Laramie Aquifer near Terry Ranch is approximately 10 to 12 feet/year, or roughly 1 mile in 500 years, and the regional groundwater flow direction is from west-north-west to east-south-east.

In the southern portion of Terry Ranch, where the Upper Laramie Formation outcrops at the surface, the aquifer is thinner and less productive. As such, the southern portion of Terry Ranch would be the last area to be developed, if developed at all. Additionally, there is still a thick vadose zone and the potential for shallow clay/shale layers that protect the Upper Laramie Aquifer to some degree in this area.

Potential Sources of Contamination

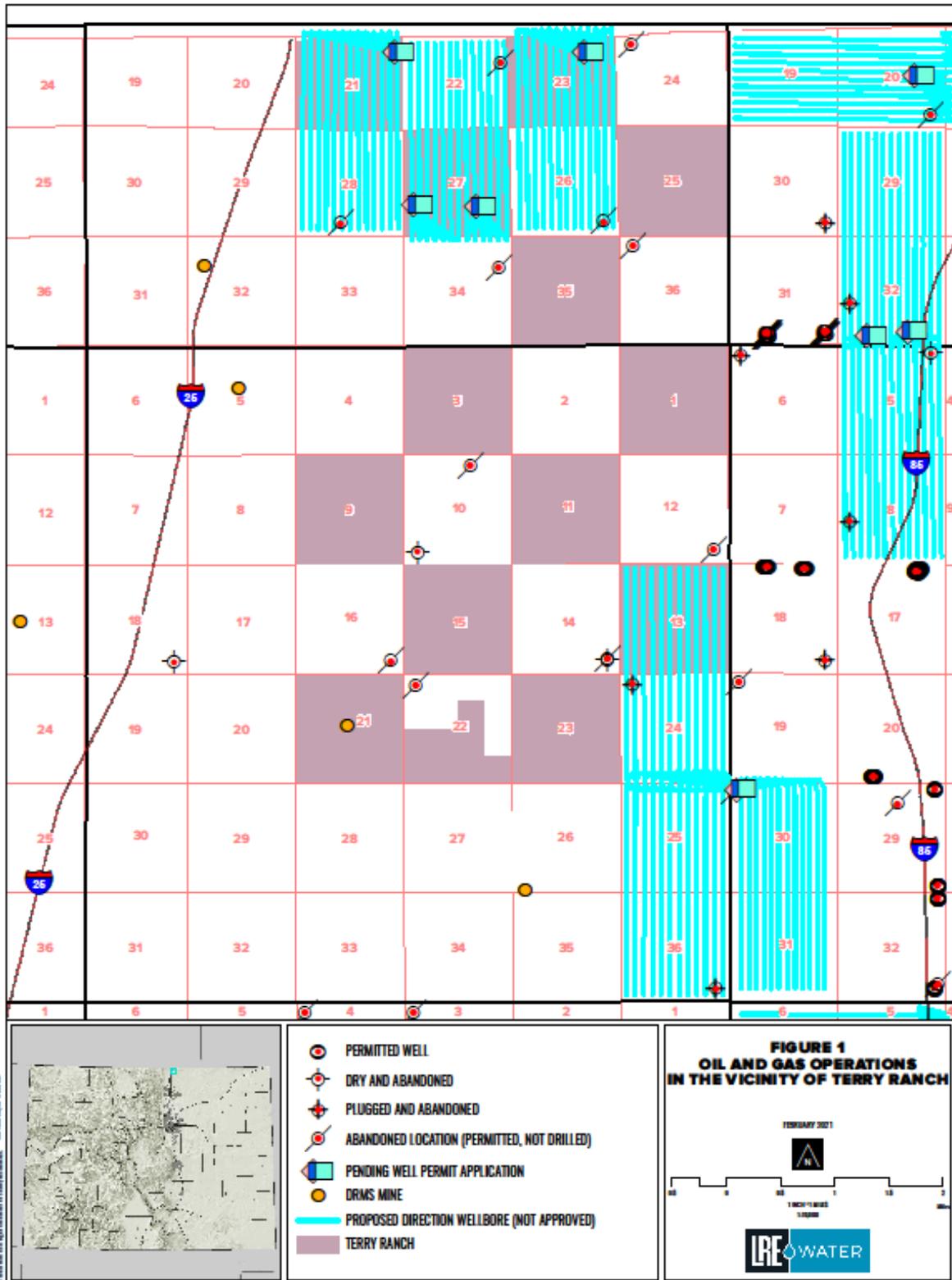
Oil and Gas Development

Currently, there is no oil and gas (O&G) development on Terry Ranch or intervening State of Colorado lands. **Figure 1** illustrates O&G well and permit locations. LRE found records of 14 drilling permits for exploratory bores on the Terry Ranch. Eleven permits were abandoned and the boreholes never drilled. The other three well permits were drilled, plugged, and abandoned, and were exploratory in nature. Although these wells were production tested, all produced volumes were less than required to support economic development. Moreover, these three wells were plugged and abandoned consistent with Colorado Oil and Gas Conservation Commission (COGCC) regulations, which require the placement of multiple cement plugs in the well bore. See the **Appendix** for COGCC reports with well abandonment records.

The lack of economic development of O&G reserves at Terry Ranch is an indicator that operators have not identified suitable hydrocarbon reserves on or near the property. Longs Peak Resources has filed permits for wells on Terry Ranch lands; however, these permits have not been issued by COGCC and have been pending since 2017 and 2018. It appears that neither the operator nor the COGCC has moved to permit these wells, even when oil prices were above \$70 per barrel. This is another indication of unsuitable hydrocarbon resources underlying Terry Ranch. Moreover, based upon a review of the COGCC records, these well permit applications do not have surface use agreements with the landowner.

The majority of mineral rights underlying Terry Ranch are owned by Etchepare, LLC, and the State of Colorado. A minor amount is owned by the Terry Grazing Association and Anadarko Land Corp. LRE examined mineral right leases dating back to 2015 and

compared them to nearby properties with active and potential energy development. Lease rates on Terry Ranch are low relative to nearby properties: \$1 to \$70 per acre on Terry Ranch compared to \$110 to \$1,200+ per acre on nearby properties. Although the economics of producing O&G on Terry Ranch are not favorable, we cannot say with certainty that there will be no future development. There could be technological advances that make it profitable to extract low levels of hydrocarbons from the reservoirs underlying Terry Ranch. However, that scenario seems unlikely in today's environment.



The accuracy of information herein is not warranted or guaranteed.

Were O&G development to occur in the future, the COGCC has various authorities to protect groundwater resources. The Upper Laramie Aquifer is formally recognized by the COGCC as a drinking water supply, and as such, operators are required to take special precautions during oil well construction. Such precautions include robust well casing requirements that must extend through the aquifer, and groundwater testing prior to and after drilling and completion. Reports of well casing failures leading to groundwater contamination are rare.

The more likely source of groundwater contamination from O&G operations is surface spills of drilling fluids, oil, etc. While there are no existing permits for oil and gas development on the property, if permits were approved the COGCC requires that any spill (including fresh water) on a drilling location of 1 barrel (42 gallon) be reported and addressed as a part of the permit approval process and on-going operations. Moreover, COGCC can apply special conditions to a drilling permit to reduce surface contamination risks. As discussed in the previous section, the intervening low-permeability formations between the ground surface and the Lower Laramie Aquifer at Terry Ranch provides natural protection from surface spills.

It should be noted that O&G development, if it occurs, would take place many thousands of feet below the Upper Laramie Aquifer. Between the petroleum hydrocarbon formations and the Upper Laramie Aquifer are several thick layers of shale and coal that act as barriers to vertical flow and inhibit contaminants from migrating from the O&G producing zone up and into the aquifer. O&G development has been ongoing beneath the Laramie-Fox Hills Aquifer in the Denver-Julesburg Basin for more than 150 years, and the Laramie-Fox Hills Aquifer provides water to several Denver Metro communities. To our knowledge, there have been no reports of contamination of the Laramie-Fox Hills Aquifer by O&G production operations.

Additionally, were O&G development to occur in the future, Greeley would have options to protect its groundwater resource.

- Greeley could intervene in COGCC hearings under Rule 303.j to request permits be withheld if Greeley can demonstrate drilling “presents an imminent threat to public health, safety, and welfare or the environment...”
- Greeley could intervene in the Weld County surface location permitting of O&G wells to demonstrate that the Greeley water supply will be negatively

impacted. Although the county process cannot prevent drilling, it can alter the location of drill pads.

- Greeley could buy the mineral rights underlying the Terry Ranch. This has not been considered given the low risk discussed above, but could in the future if development appeared imminent.

Mining

LRE's research discovered one mine on the Terry Grazing Property – Permit No. M2014001. This mine is an active surface sand and gravel mine that has not exposed or intercepted groundwater, and as such does not pose a contamination risk. There are two additional active mines west and south of the property (M1980002 and M1988048). The mine with permit no. M1980002 (west of the property) is a sand and gravel mine with no ongoing excavation. The operator is still operating the mine to remove and sell stockpiled material and to restore the property back to ranch land. The mine with permit no. M1988048 (south of Carr, CO) is an operating sand and gravel mine with excavation ongoing. Neither mine has encountered or impacted groundwater. **Figure 1** shows the locations of the mines near Terry Ranch.

Roadways and Railways

There are two major roadways and one railway in the vicinity of Terry Ranch: (1) Interstate twenty-five (I-25) on the West, (2) Weld County Road 126 (Weld 126) to the South and (3) a Class 1 Railway operated by Union Pacific (UP) that trends north to south centrally through the property (the locations are shown on **Figure 2**). There are two potential groundwater contamination risks associated with roads and railroads:

1. Surficial release of non-hazardous and hazardous materials from vehicle accidents and/or train derailments, and;
2. Increased salt content from roadway de-icing operations (e.g., Chloride (Cl)).

In the event that a spill from either source were to occur, it would likely be identified and cleaned up prior to impacting groundwater. LRE did not identify an incident of a train derailment between the Town of Carr and the northern boundary of Terry Ranch in historical records from the National Transportation Safety Board and the Department of Transportation National Archives (NTSB, DOTNA, 2021). If the groundwater underlying Terry Ranch were impacted by road de-icing, there would be elevated levels of chloride

in the groundwater. Due diligence studies at Terry Ranch measured chloride concentrations in the groundwater at consistently low levels (< 10 mg/L).

Spills from accidents can impact wells through two modes: (1) infiltrated into the aquifer from the ground surface, or (2) flow over ground to the well head and into the aquifer. As discussed in the previous section, the aquifer is generally protected from land surface activities and, therefore, the primary mode of flow for contaminants to impact groundwater is at or around well heads. Thus, wells are typically offset from roadways and railways as a precaution. **Table 1** shows the distances from production wells WWR-1, WWR-2, WWR-3, WWR-4, WWR-5 to the UP Railway, I-25, and Weld 126. Numbers in bold indicate that the well location is down-gradient of the respective road or railway, but is at a sufficient distance from a potential chemical loading site (i.e., a surface spill from a roadway accident or train derailment) according to Protecting Your Private Well, a publicly available document developed by the Colorado Division of Water Resources (CDWR), the Colorado Department of Agriculture, Colorado Water Institute Colorado State University, and the United States Department of Agriculture (Waskom et. al, 2009). Numbers in italics indicate that the well location is up-gradient of the respective road or railway and at a sufficient distance from a potential chemical loading site.

There is negligible contamination risk to the overall groundwater quality because of the locations of the Terry Ranch production wells with respect to road and railway locations. Future wells can be located in similar fashion to mitigate the risk of contamination.

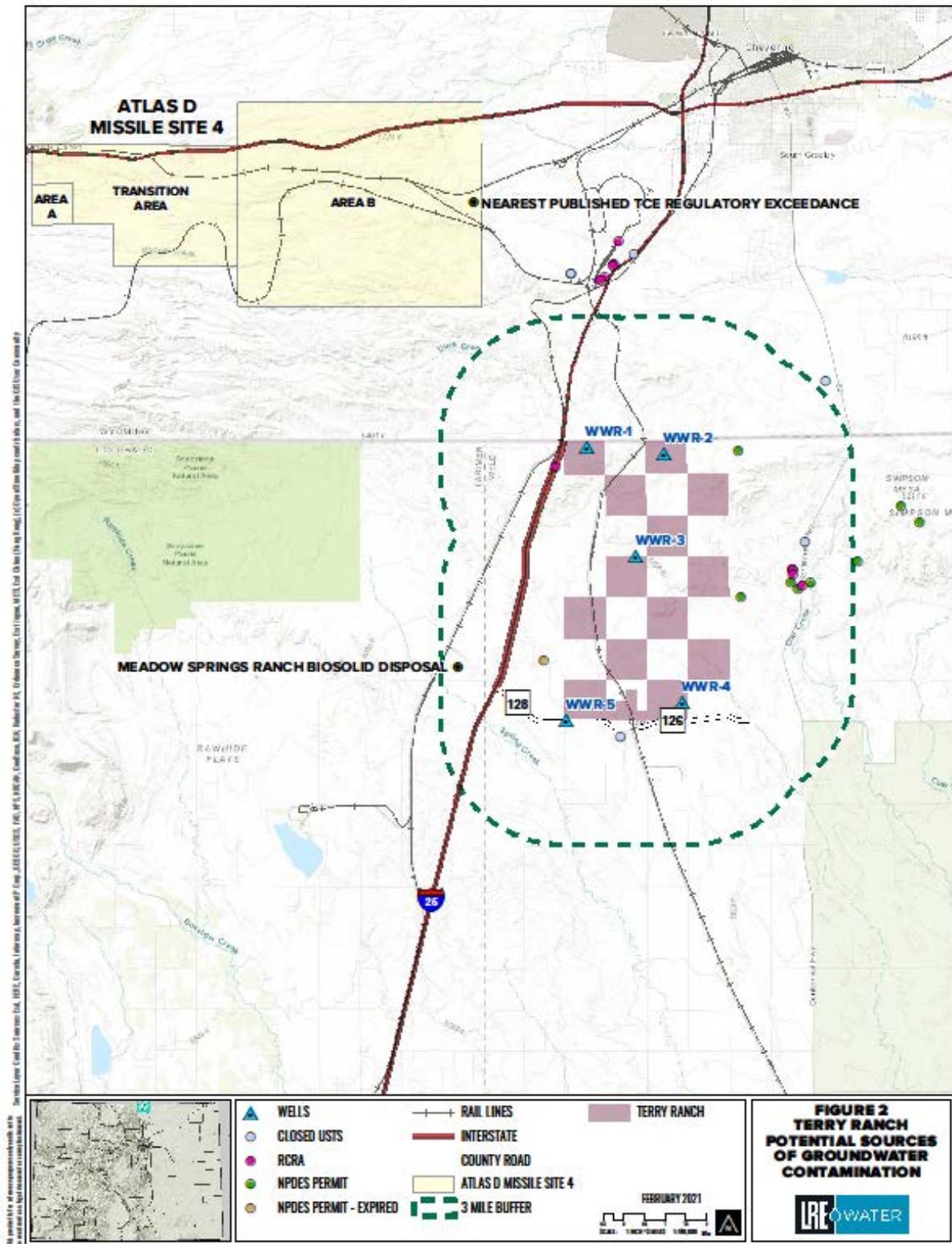


Table 1: Well Head Offsets from Roadways and Railways

Well ID	Distance to I-25 (feet)	Distance to UP Railroad (feet)	Distance to Weld 126 (feet)
WWR-1	3,300	<i>5,000</i>	<i>35,000</i>
WWR-2	13,000	3,200	<i>34,000</i>
WWR-3	13,700	5,500	<i>22,000</i>
WWR-4	23,000	6,700	<i>2,400</i>
WWR-5	9,700	<i>8,100</i>	<i>180</i>

In summary, the proximity of Terry Ranch to the UP Railroad, I-25, and Weld 126 does not present probable or reasonable risk to the groundwater quality. Future production wells can be designed in accordance with the Ground Water and Wellhead Protection Handbook developed by the United States Environmental Protection Agency (USEPA) and Colorado-specific guidelines to ensure the protection of the groundwater resources (USEPA, 1994) to protect the groundwater from roadways and railways.

Atlas D Missile Site 4

The Atlas D Missile Site 4 in Laramie County, Wyoming is a former defense site that was in operation from 1959 to 1962 (Missile Site) located approximately 15 miles north-west of Terry Ranch, shown on **Figure 2**. The property is now owned by the City of Cheyenne for grazing purposes. During historic operations, trichloroethelene (TCE) was used and disposed of in ponds surrounding the Site. Today, TCE is a recognized carcinogen with a regulatory limit of 5 micrograms per liter (ug/L) in drinking water (EPA 2021). The Wyoming Department of Environmental Quality (WDEQ) and the Army Corps of Engineers (USACE) has overseen the cleanup and characterization of the Missile Site TCE plume since 2003. Through an extensive monitoring program, the WDEQ and USACE have characterized the extent of the TCE plume (Final Area RI 2019).

TCE is a Dense Non-Aqueous Phase Liquid (DNAPL) and is more dense than water, meaning it sinks when interacting with water. The USACE has found that the highest concentrations of TCE are at the base of the Ogallala Aquifer and the upper unit of the White River Formation, terminating at the relatively impermeable Brule Member of the White River Formation. The Brule Member acts as a barrier to downward migration of the TCE and protects the underlying Upper Laramie Aquifer.

The source area, known as Site A, is located approximately one mile south of the Town of Granite, Wyoming, where the highest concentrations of TCE have been measured in soil and groundwater. Although the TCE source is at the surface, because it is denser than water, it currently flows down gradient along the base of the Ogallala and in the upper portion of the underlying White River Formation.

Reports indicate that the eastern edge of the TCE plume (Site B) is moving at a rate of approximately 0.1 feet/day (approximately 1 mile per 145 years) in the White River Formation (Final Area RI 2019), and 1.3 feet/day in the Ogallala Aquifer (approximately 1 mile per 11 years). The closest monitoring well with an exceedance of 5 ug/l of TCE is 6.2 miles from the northern edge of the Terry Ranch property, as shown on **Figure 2**. Based on the velocity of the plume migration, it would take approximately 900 years for TCE in the White River Formation and 69 years in the Ogallala to reach Terry Ranch. If TCE were to reach Terry Ranch in the Ogallala, it would be of minimal concern because the Upper Laramie Aquifer is protected by the Brule Formation. Additionally, in that amount of time, and over that distance, it is likely that the TCE that is not actively remediated would partially or fully attenuate naturally by a combination of 1) dechlorination by dehalogenating bacteria, 2) enzymes produced by certain bacteria that dechlorinate, and/or 3) Abiotic degradation in the presence of iron-rich soils/rocks (Schwarzenbach, 2002). In addition, the plume would have to change direction and migrate to the south.

The TCE plume is not a contamination risk to the Terry Ranch Project because Terry Ranch is located sufficiently far away, the plume is migrating slowly and not in the direction of Terry Ranch, the plume is well-characterized and actively being remediated, and the Upper Laramie Aquifer is hydraulically separated by the overlying Brule Member.

Fort Collins' Meadow Springs Ranch Biosolids Disposal

Brown and Caldwell, and LRE evaluated the risks of groundwater contamination from the Meadows Springs Ranch Biosolids Disposal Site, which is outlined in the *Meadow Springs Ranch Technical Memorandum* (December 9, 2020). This biosolids disposal facility follows state and federal regulations that are designed to prevent the contamination of surface water and groundwater. In 1993, a demonstration test of the facility did not show “negative impacts to wildlife, the environment, soils, surface water, or groundwater.”

LRE conducted a particle trace analysis using its MODFLOW groundwater flow model of the Upper Laramie Aquifer to estimate the amount of time it would take for natural recharge originating near Meadow Springs Ranch to reach Terry Ranch. The model estimates that it would take approximately 1,400 years for natural recharge at this location to reach the southwestern boundary of Terry Ranch near WWR-5. Considering the slow groundwater travel times in the Upper Laramie Aquifer, surface activities in the aquifer's recharge area to the west of Terry Ranch pose very little risk to groundwater quality underlying the Property. The particle trace analysis is inherently conservative, meaning that it does not take into account the other physical, chemical, and biological processes (dispersion, diffusion, sorption, degradation, and attenuation) that can occur as a contaminant is transported within the aquifer. These processes tend to reduce the concentration of a substance over its migration path, or potentially remove it from the groundwater entirely (e.g., sorption or precipitation).

Other Potential Sources of Groundwater Contamination

LRE Water conducted a search for identified groundwater contamination sources within five miles of Terry Ranch using the EPA Enforcement and Compliance History Online (ECHO), the Resource Conservation and Recovery Act Information (RCRA), Underground Storage Tanks (UST/LUST) and the Toxics Release Inventory (TRI) databases. LRE focused the screening evaluation on facilities located within three miles of Terry Ranch that could be disposing of, releasing, or generating hazardous waste and materials that could potentially impact groundwater quality. Assuming an average linear groundwater flow velocity of 10 to 12 feet/year, a contaminant that enters the aquifer three miles up-gradient of Terry Ranch would take over 1,000 years to reach the property.

LRE identified four RCRA facilities within three miles of the property boundary. **Figure 2** shows the location of the potential sources of contamination found within three and five miles of the property. The three RCRA sites to the south-east of the property are not of concern since they are located down-gradient of the groundwater movement. There is a Very Small Quantity Generator (VSQGs) natural gas company located upstream of Terry Ranch and does not have identified violations to its permit. The location of this site is not of concern because it is classified as a VSQG with no violations and is located where the White River Formation is at the surface, which acts as a hydrologic barrier and protects the underlying Upper Laramie Aquifer. LRE identified four UST locations within three miles of Terry Ranch. These sites are not active and are labeled as "Closed" per the EPA UST database, so they do not pose a contamination risk to Terry Ranch groundwater.

LRE conducted a review of dischargers with a current National Pollutant Discharge Elimination System (NPDES) permit within five miles of Terry Ranch. LRE identified six dischargers inside the 3-mile radius, five of which are located east of the property, discharging to Owl Creek. LRE determined that these six dischargers are not of concern given they are located down-gradient of Terry Ranch, discharge to a stream, and operate pursuant to a Colorado Department of Public Health and Environment (CDPHE) discharge permit. One discharger was identified on the southwest side of the property. This specific discharger does not pose a risk to the aquifer as its permit has expired and the site is inactive per the Water Quality Control Division – COG500000 Annual Report Form filed for the 2020 reporting period.

Groundwater Quality Protection Measures

The following are preventive measures City can implement to protect groundwater quality at Terry Ranch.

1. **Proper Well Construction** – construct wells with the State-required 40-foot surface seal. This is a cement grout seal in the annulus between the surface casing and borehole wall. In addition, seal the annulus between the surface casing and the well casing to just above the top of screen.
2. **Well Siting** – locate future wells away from roadways and railways, and preferably in the northern two-thirds of the property where the Upper Laramie Formation is not exposed at the surface and groundwater levels are deepest.
3. **Groundwater Monitoring Wells** – construct groundwater monitoring wells up-gradient of the property boundaries (sometimes referred to as sentinel wells) to monitor the quality of groundwater moving toward Terry Ranch.
4. **Limit Surface Activities** – limit surface activities on the property, particularly in the southeastern portion where the Upper Laramie Formation is exposed at the surface and groundwater levels are shallowest.

Conclusions and Recommendations

Conclusions:

1. Based on LRE's review of sources of groundwater contamination in vicinity of Terry Ranch, the risks of anthropogenic contamination of the groundwater are low.

2. The Upper Laramie Aquifer underlying Terry Ranch is protected by the overlying White River Formation on the northern half of the property, and is property is located in a relatively pristine and undeveloped area.
3. In general, surface contaminants pose a greater risk to surface water supplies than deep bedrock groundwater supplies, such as the Upper Laramie Aquifer underlying Terry Ranch.

Recommendations:

1. As a precaution, Greeley should consider implementing a groundwater monitoring program along the western and north-northwestern edges of the property because these areas are up-gradient of the prevailing groundwater flow direction.
2. If unforeseen O&G operations were to begin in the vicinity of Terry Ranch, then Greeley could legally oppose the development or work with Weld County and operators to implement a groundwater monitoring program around the operations.

References

Ground Water and Wellhead Protection Handbook (GWWHP), September, 1994. The United States Environmental Protection Agency. Office of Research and Development. Office of Ground Water and Drinking Water.

Waskom M., Reagan, Bauder A., Troy, Wawrzynski, Rob, Wolfe, Dick, and Fields, Debbie. Protecting Your Private Well: Bulletin #XCM-179. Colorado State University: Colorado Water Institute, Colorado Department of Agriculture, Colorado Division of Water Resources. June 2009.

Final Area-Wide Remedial Investigation Report Former Atlas D Missile Site 4 Laramie County, Wyoming Contract No. W9128F-13-D-0004, 0001 FUDSID#B08WY0467 Final Letter Report—Fall 2019 Residential Wells Interim Monitoring & Residential GAC System O&M Activities Former Atlas “D” Missile Site 4, Cheyenne, Wyoming

Swinehart et al., 1985. Cenozoic Paleogeography of Western Nebraska. Rocky Mountain Section, SEPM, Rocky Mountain Paleogeography Symposium 3, Denver, Colorado; Swinehart, J.B., Souders, V.L., Degraw, H.M., and R.F. Diffendal, Jr.; 1985.

TriHydro, 2009. Project Report, Belvoir Ranch High Plains Aquifer White River Study, prepared for Cheyenne Board of Public Utilities, City of Cheyenne, Wyoming and the Wyoming Water Development Commission; TriHydro Corp., 2009.

Bartos et al., 2013. Geologic and Hydrogeologic Characteristics of the Ogallala Formation and White River Group, Belvoir Ranch near Cheyenne, Laramie County, Wyoming, USGS SIR 2013-5242; Bartos, T.T.; Diehl, S.F.; Hallberg, L.L.; and D.M. Webster, 2013.

EPA.gov website. Reference for TCE (<https://www.epa.gov/sites/production/files/2016-09/documents/trichloroethylene.pdf>)

Schwarzenbach, P. R., Gschwend, P. M., Imboden, D. M. (2002). Environmental Organic Chemistry. First published: 23 August 2002

Appendix A – Oil and Gas Well Abandonment Reports

OIL AND GAS CONSERVATION COMMISSION
DEPARTMENT OF NATURAL RESOURCES
OF THE STATE OF COLORADO

RECEIVED
MAY 11 1972



File in duplicate for Patented and Federal lands
File in triplicate for State lands. COLO. OIL & GAS CONS. COMM.

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir.
Use "APPLICATION FOR PERMIT" for such proposals.)

1. OIL WELL GAS WELL OTHER Dry Hole

2. NAME OF OPERATOR
Rainbow Resources, Inc.

3. ADDRESS OF OPERATOR
c/o McIlhenny-Adams & Co., Inc.
Rm 103 - 152 N. Durbin, Casper, Wyoming 82601

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.
See also space 17 below.)
At surface
660' FEL & 660' FSL, C SE SE Sec. 14-11N-67W
At proposed prod. zone

14. PERMIT NO. 71-933

15. ELEVATIONS (Show whether DF, RT, GR, etc.)
5740' G.L.

5. LEASE DESIGNATION AND SERIAL NO.
71516

6. IF INDIAN, ALLOTTEE OR TRIBE NAME

7. UNIT AGREEMENT NAME

8. FARM OR LEASE NAME
State Lone Tree

9. WELL NO.
#1-14

10. FIELD AND POOL, OR WILDCAT
Wildcat

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA
Sec. 14=11N-67W

12. COUNTY Weld

13. STATE Colorado

16. Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
TEST WATER SHUT-OFF <input type="checkbox"/>	PULL OR ALTER CASING <input type="checkbox"/>	WATER SHUT-OFF <input type="checkbox"/>	REPAIRING WELL <input type="checkbox"/>
FRACTURE TREAT <input type="checkbox"/>	MULTIPLE COMPLETE <input type="checkbox"/>	FRACTURE TREATMENT <input type="checkbox"/>	ALTERING CASING <input type="checkbox"/>
SHOOT OR ACIDIZE <input type="checkbox"/>	ABANDON <input type="checkbox"/>	SHOOTING OR ACIDIZING <input type="checkbox"/>	ABANDONMENT <input checked="" type="checkbox"/>
REPAIR WELL <input type="checkbox"/>	CHANGE PLANS <input type="checkbox"/>	(Other) <input type="checkbox"/>	

(NOTE: Report results of multiple completion on Well Completion or Recompletion Report and Log form.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)

Date of work December, 14, 1971

Well was plugged and abandoned on December 14, 1971 as follows:
100 sacks cement solid across Fox Hills (Approx. 1450 - 1750')
15 sacks at base of surface pipe.
Cut off below plow depth.

Location has been cleaned and reseeded with crested wheat grass and is ready for inspection.

DVR	
FJP	<input checked="" type="checkbox"/>
HHM	<input checked="" type="checkbox"/>
JAM	<input checked="" type="checkbox"/>
JJD	<input checked="" type="checkbox"/>

18. I hereby certify that the foregoing is true and correct

SIGNED E.W. McIlhenny TITLE Agent DATE 5-9-72

(This space for Federal or State office use)

APPROVED BY [Signature] TITLE DIRECTOR DATE MAY 18 1972

CONDITIONS OF APPROVAL, IF ANY:



02332053

FORM 6 Rev 02/11

State of Colorado Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80205 Phone: (303) 894-2100 Fax: (303) 894-2109



DE ET OE ES

Date Received:

4/3/12

Document Number:

WELL ABANDONMENT REPORT

This form is to be submitted as an Intent to Abandon whenever an abandonment is planned on a borehole. After the abandonment is complete, this form shall again be submitted as a Subsequent Report of the actual work completed. The approved intent shall be valid for six months after the approval date, after that period, a new intent will be required. Attachments required with the Intent to Abandon are wellbore diagrams of the current configuration and the proposed configuration with plugs set. A Subsequent Report of Abandonment shall indicate the actual work completed. Attachments required with a Subsequent Report are a wellbore diagram showing plugs that were set and casing remaining in the hole, the job summaries from all plugging contractors used, including wireline and cementing (third party verification) and any logs that may have been run during abandonment.

OGCC Operator Number: 10334 Contact Name: Don Smith
Name of Operator: Slawson Exploration Company Inc. Phone: (303) 592-8880
Address: 1675 Broadway Suite 1600 Fax: (303) 592-8881
City: Denver State: CO Zip: 80202 Email: dsmith@slawsoncompanies.com
For Intent 24 hour notice required, Name: Tel:
COGCC contact: Email:

API Number 05-123-31793-
Well Name: BUSHWACKER Well Number: 24-11-67H
Location: QtrQtr: NWNW Section: 24 Township: 11N Range: 67W Meridian: 6 PM
County: Weld Federal, Indian or State Lease Number: 8750.5
Field Name: Wildcat Field Number: 99999

[X] Notice of Intent to Abandon [] Subsequent Report of Abandonment

Only Complete the Following Background Information for Intent to Abandon

Latitude: 40.912410 Longitude: -104.846570
GPS Data:
Data of Measurement: 10/13/10 PDOP Reading: 1.5 GPS Instrument Operator's Name: Brian Brinkman
Reason for Abandonment: [] Dry [X] Production for Sub-economic [] Mechanical Problems
[] Other
Casing to be pulled: [X] Yes [] No Estimated Depth: 7300'
Fish in Hole: [] Yes [X] No If yes, explain details below
Wellbore has Uncemented Casing leaks: [] Yes [X] No If yes, explain details below
Details: Cut off above TOC and recover 7" casing @ ~7300'.

Current and Previously Abandoned Zones

Table with columns: Formation, Code, Perf. Top, Perf. Btm, Date, Method of Isolation, Plug Depth. Total: 0 zone(s)

Casing History

Table with columns: Casing Type, Size of Hole, Size of Casing, Weight Per Foot, Setting Depth, Sacks Cement, Cement Bot, Cement Top, Status. Rows for Surface and Intermediate casing.

Plugging Procedure for Intent and Subsequent Report

4/3/12

CIBP #1: Depth _____ with _____ sacks cmt on top. CIPB #2: Depth _____ with _____ sacks cmt on top.
 CIBP #3: Depth _____ with _____ sacks cmt on top. CIPB #4: Depth _____ with _____ sacks cmt on top.
 CIBP #5: Depth _____ with _____ sacks cmt on top.

NOTE: Two(2) sacks cement required on all CIBPs.

Set <u>15</u>	sks cmt from <u>8100</u>	ft. to <u>8000</u>	ft. in	Plug Type: <u>Liner</u>	Plug Tagged: <input type="checkbox"/>
Set <u>30</u>	sks cmt from <u>7350</u>	ft. to <u>7250</u>	ft. in	Plug Type: <u>Stub</u>	Plug Tagged: <input type="checkbox"/>
Set <u>40</u>	sks cmt from <u>350</u>	ft. to <u>250</u>	ft. in	Plug Type: <u>Stabilizer</u>	Plug Tagged: <input type="checkbox"/>
Set _____	sks cmt from _____	ft. to _____	ft. in	Plug Type: _____	Plug Tagged: <input type="checkbox"/>
Set _____	sks cmt from _____	ft. to _____	ft. in	Plug Type: _____	Plug Tagged: <input type="checkbox"/>

Perforate and squeeze at _____ ft. with _____ sacks. Leave at least 100 ft. in casing _____ CICR Depth
 Perforate and squeeze at _____ ft. with _____ sacks. Leave at least 100 ft. in casing _____ CICR Depth
 Perforate and squeeze at _____ ft. with _____ sacks. Leave at least 100 ft. in casing _____ CICR Depth
(Cast Iron Cement Retainer Depth)

Set 50 sacks half in. half out surface casing from 1900 ft. to 1800 ft. Plug Tagged:

Set 10 sacks at surface.

Cut four feet below ground level, weld on plate Above Ground Dry-Hole Marker: Yes No

Set _____ sacks in rat hole Set _____ sacks in mouse hole

Additional Plugging Information for Subsequent Report Only

Casing Recovered: _____ ft. of _____ inch casing Plugging Date: _____
 *Wireline Contractor: _____ *Cementing Contractor: _____

Type of Cement and Additives Used: _____
 Flowline/Pipeline has been abandoned per Rule 1103 Yes No *ATTACH JOB SUMMARY

Provide Technical Detail:

I hereby certify all statements made in this form are, to the best of my knowledge, true, correct, and complete.

Signed: _____ Print Name: Don Smith, PE
 Title: Special Projects Engineer Date: 04/02/2012 Email: dsmith@slawsoncompanies.com

Based on the information provided herein, this Well Abandonment Report (Form 6) complies with COGCC Rules and applicable orders and is hereby approved.

COGCC Approved: _____ Date: _____

CONDITIONS OF APPROVAL, IF ANY: _____

Attachment Check List

Att Doc Num	Name
1	Well bore diagram "As Is" and "Proposed P&A"

Total Attach: _____

OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

RECEIVED ✓

JAN 7 1969

PLUGGING RECORD

COLO. OIL & GAS CONS. COMM.



00244874

INSTRUCTIONS

Within thirty (30) days after the plugging of any well, the owner or operator thereof shall file this form in duplicate for wells on Patented or Federal lands, and in triplicate for wells on State lands, give a detailed account of the manner in which the abandonment or plugging work was carried out, including the nature and quantities of materials used in plugging and the location and extent (by depths) of the plugs of different materials; records of the amount, size and location (by depths) of casings and junk left in the well; and a detailed statement of the volume and weight of mud fluid used.

Operator King Resources Company-International Nuclear Field Corp Wildcat X
 Lease Name INC-State Well No. 1 County Weld
 Location SW SW Section 10 Township 11N Range 67W Meridian 6th PM
 (Quarter Quarter)
610 feet from S Section line and 660 feet from W Section Line
 N or S E or W

TOTAL DEPTH 9971' DATE OF PLUGGING 12-29-68 ✓

DETAILS OF WORK

12-19-68: TD 9530'. DST #1, Greenhorn 9320-9450, Rec. 50' mud, Very weak blow.

12-28-68: Drilled to TD 9971'. Ran DIL and RDC electric logs. No production possibilities indicated.

12-29-68: Plugged well as follows:

- 25 sx - 9750'
- 25 sx - 4000'
- 25 sx - 517' (across base of surface casing.)
- 15 sx - surface

Dry hole marker erected.

DVR	
FJP	✓
HHM	✓
JAM	✓
JJD	✓

I/we hereby swear (or affirm) that the statements herein made are a full and correct report:

Approved: _____ Date JAN 9 1969
 Company King Resources Company Date 1-6-69
 600 Denver Club Bldg.
 Address Denver, Colorado 80202 Phone No. 292-0264
 Director [Signature] By [Signature] Title Clerical Supervisor
 (Signature)

✓