UICI - 11

FALL-OFF TEST

2022

UIC CLASS I FALL-OFF TEST REPORT

WESTERN REFINING SOUTHWEST LLC
WASTE DISPOSAL WELL No. 2

API NO.:	30-045-35747
UIC PERMIT:	UICI-011
LOCATION:	BLOOMFIELD, NM
START DATE:	09/14/2022
FINISH DATE:	09/29/2022
PROJECT ID:	MPC.FNM.22.01

PREPARED BY:	DAVID ZOOK
APPROVED BY:	BRANDON SCHULTE
REPORT DATE:	11/04/2022

STRATA, LLC

4151 SW FREEWAY, SUITE 345

HOUSTON, TX 77027

solutionsbystrata.com

CONTENTS

EXECUTIVE SUMMARY 1
1 SITE INFORMATION 2
1.1 FACILITY INFORMATION 2
1.2 WELL INFORMATION 2
1.3 GEOLOGY 2
1.4 AREA OF REVIEW (AOR) AND OFFSET WELLS 3
2 TEST ACTIVITY AND DATA 4
2.1 INJECTION FLUID, RATE AND VOLUME 4
2.2 PRESSURE FALL-OFF TEST ACTIVITY 4
3 FALL-OFF ANALYSIS 6
3.1 PARAMETER ESTIMATION FOR INJECTION INTERVAL AND FLUID PROPERTIES 6
3.2 SEMI-LOG ANALYSIS – HORNER METHOD (CLASSIC) 6
3.2.1 FLOW CAPACITY 7
3.2.2 PERMEABILITY 7
3.2.3 TRANSMISSIVITY 8
3.2.4 INITIAL RESERVOIR PRESSURE 8
3.2.5 SKIN FACTOR 8
3.2.6 PRESSURE DROP DUE TO SKIN 9
3.2.7 FLOW EFFICIENCY 9
3.2.8 DRAINAGE AREA (RADIUS OF TEST INVESTIGATION) 10
3.3 WASTE FRONT DISTANCE 10
3.4 WASTE FRONT TIME 11
3.5 HOMOGENEOUS TYPE-CURVE (LOG-LOG) MODEL ANALYSIS 12
3.6 RESULTS SUMMARY 13
4 CONCLUSIONS 15
4.1 DISCUSSION OF RESULTS 15
4.2 RECORD KEEPING 15
5 REFERENCES 16
6 APPENDICES 17

FIGURES

SEE APPENDIX A.....A

TABLES

TABLE 1. FACILITY INFORMATION. 2
TABLE 2. WELL INFORMATION. 2
TABLE 3. PRESSURE AND TEMPERATURE FROM STATIONARY GRADIENT SURVEY ON 9/14/22. 5
TABLE 4. PRESSURE/TEMPERATURE GAUGE SPECIFICATIONS. 5
TABLE 5. INPUT PARAMETERS. 6
TABLE 6. FLUID PROPERTIES. 6
TABLE 8. SEMI-LOG ANALYSIS, HORNER METHOD (CLASSIC) 13
TABLE 9. HOMOGENOUS TYPE-CURVE (LOG-LOG) MODEL ANALYSIS 13
TABLE 10. COMPARISON WITH PREVIOUS FALL-OFF TESTS. 14

APPENDICES

APPENDIX A. FIGURES

APPENDIX B. TEST FIELD REPORT

APPENDIX C. INJECTION DATA

APPENDIX D. COPY OF ELECTRIC LOG

APPENDIX E. AREA OF REVIEW TABLE

APPENDIX F. INJECTION AND FORMATION FLUID ANALYSIS

APPENDIX G. TOOL CALIBRATION

EXECUTIVE SUMMARY

Strata, LLC completed a Pressure Fall-Off Test on Western Refining Southwest LLC Waste Disposal Well No. 2 (WDW-2) located near Bloomfield, NM. The test was conducted and analyzed according to OCD UIC Class I Well Fall-Off Test Guidance and the approved procedure submitted prior to the test.

Down-hole pressure gauges were set at the top of the injection interval and waste injection commenced on September 14, 2022. After 73.41 hrs of injection the well was shut in to monitor pressure falloff for 284.09 hrs (11.8 days).

Radial flow conditions were observed from 3.274 hrs to 12.58 hrs after shut-in. The permeability was measured to be 2.45 md, the transmissivity 643 md-ft / cp, and skin -4.03. The static gradient survey measured the average fluid gradient as 0.433 psi/ft. There were no anomalous temperature or pressure measurements. An update to the 2021 1-mile Area-of-Review found no new wells and no change to existing wells.

Brandon Schulte 11/4/2022

Test Supervisor: Brandon Schulte, P.E. (NM License No. 25721)
Sr. Project Manager
Strata, LLC

1 SITE INFORMATION

Strata, LLC was contracted to plan and oversee injection pressure fall-off test on the subject well. The following sections provide site and well identification information, an updated Area-of-Review, and other data as required by *New Mexico Oil Conservation District UIC Class I Well Fall-Off Test Guidance*, December 3, 2007.

1.1 FACILITY INFORMATION

Facility information is given in **Table 1**.

Table 1. Facility information.

NAME	Western Refining Southwest LLC
LOCATION	50 County Road 4990 Bloomfield, NM 87413
OGRID NUMBER	267595

1.2 WELL INFORMATION

Well information is given in **Table 2**. A schematic of the well is provided in **Appendix A, Figure 1.**

Table 2. Well Information.

OCD UIC Permit Number	UICI-011
Well Classification	Class I Non-hazardous
Well Name and Number	WDW No. 2
API Number	30-045-35747
Legal Location	2028' FNL 111' FEK Unit Letter H of Section 27, T29N, R11W

1.3 GEOLOGY

The geology is reproduced from the Fall-Off Test (William M. Cobb and Associates, Inc., 12/12/17).

> *"The injection zone is the Entrada sandstone formation. The formations occur in Waste Disposal Well No. 2 at the depths shown in the table below. The injection zone is shown in Waste Disposal Well No.2 logs in Appendix D.*

Injection Zone Formation	*Waste Disposal Well #2 (KB elev = 5,550 ft*	
	MD below KB (ft)	*SS Depth (ft)*
Bluff Sandstone	*Not completed*	7031
Entrada Sandstone	7312 to 7470	7308

> *The Jurassic aged Entrada Sandstone is thought to be one of the best water disposal rock units in the San Juan Basin. The Entrada is the basal formation of the San Rafael Group which also*

includes the Todilto and Wanakah Formations The Entrada Sandstone is present throughout the basin's subsurface and crops out along the it's margin as step cliffs. The Entrada unconformably overlies the Chinle Formation. The overlying Todilto Formation made up of limestone and anhydrite in dense and thought to an impermeable barrier or seal.

The Entrada Sandstone consists of mottled reddish-brown very fine to medium grained well sorted, silica cemented quartz sandstone interbedded with thinner reddish-brown siltstones. The sandstone units are assembled in high-angle, large-scale crossbeds indicating eolian environment deposition and with the siltstones representing interdue and sabkha deposition. The cross stratified sandstone is competent, laterally persistent and with homogenous reservoir properties. Entrada Sandstone gross thickness ranges 60 feet to 330 feet across the basin.

At the Water Disposal Well #2 location the Entrada is 158 feet thick. Based upon the nearby XTO Energy Ashcroft SWD #1 water disposal well density porosities are up to 18 percent with the most porous interval found in the upper 90 feet of the formation where the majority of the density porosities are more than 10 percent. Water Disposal Well #2 has a density porosity of 12.1 percent. The two intervals with the highest porosity are 20 feet from 7,333 feet to 7,353 feet with 14.1 percent porosity and 26 feet from 7,442 feet to 7,468 feet with 14.3 percent porosity.

Permeability for the well as measured by this falloff test is 3.29 md or less."

A section of the neutron density log, from 7200 ft. to 7532 ft., and a section of the dual induction log from 7200 ft. to 7532 ft., is provided in Appendix D. These logs were previously filed with the OCD.

1.4 AREA OF REVIEW (AOR) AND OFFSET WELLS

Federal Abstract Company conducted an Area-of-Review (AOR) search for new wells or changes to existing wells within one mile of WDW-2. The AOR search includes both new wells and changes to existing wells. Results of the search are summarized below. A complete AOR table is provided in Appendix E and an AOR map is shown in Figure 11.

New Wells

No new wells were drilled in the AOR since the previous AOR review.

Changes to Wells

No wells reported a change in status since the previous AOR review.

Wells Plugged and Abandoned

No wells were plugged and abandoned since the previous AOR review.

Wells Temporarily Abandoned

No wells were temporarily abandoned since the previous AOR review.

Offset Wells

Ashcroft SWD #001 (Record No. 48, API No. 30-045-30788) penetrates the Entrada injection zone. There are no reported changes to this well.

2 TEST ACTIVITY AND DATA

The pressure fall-off test and static fluid level measurement was conducted on September 14 - 29, 2022. A record of the daily well test activities is in **Appendix B**.

2.1 INJECTION FLUID, RATE AND VOLUME

The fluid injected for the falloff test is terminal-treated wastewater (effluent). An analysis of the effluent injectate is provided in **Appendix F,** along with a summary of an analysis of the formation water collected on January 25, 2017.

The cumulative volume injected into WDW-2 through the end of the falloff test is 9,089,116 gallons.

The rate history used in the falloff analysis begins at the shut-in of the previous falloff test and ends with the well shut-in during the current falloff test. The rate history is provided in **Appendix C.**

2.2 PRESSURE FALL-OFF TEST ACTIVITY

Activities for the pressure fall-off test were initiated Wednesday, September 14, 2022. Prior to starting pressure fall-off test activities, a Bradenhead Test was completed. The test was successful and witnessed by John Durham. The Bradenhead Test is reported separately.

The slickline unit and lubricator were rigged up. An impression block was descended into the well and tagged fill depth at 7,423 feet KB. The plug back total depth is noted from previous completion schematics at a depth of 7,490 feet bgs. Estimated fill in the well is 67 feet.

The pressure/temperature tool then was descended into the well and set to a depth of 7,312 feet below ground surface (bgs) at 11:32 AM. Fluid injection began at 11:40 AM. Terminal-treated wastewater (effluent) was utilized as injectate.

The total injected volume for the test was 133,132 gallons for a total period of 73.41 hrs. Waste was injected at an average flow rate of 44.82 gpm for 21.33 hrs followed by 25.56 gpm for 52 hrs. The injection rate was lowered after the initial rate resulted in pressure building too quickly.

Pressure and temperature were monitored during the pressure fall-off period for 284.09 hours. The pressure fall-off test was concluded on September 29th at 7:45 AM. **Figure 2** is a plot of the pressure and rate history recorded during the September 14 – 29, 2022 test. The final injection pressure was 4,419.98 psi. Final shut-in pressure at the end of 284.09 hours was 3,709.16 psi. The total absolute change in pressure for the shut-in period was a decrease of 710.83 psi. The final injection fluid temperature was 136.89°F. The final shut-in injection fluid temperature was 186.79°F, an increase of 49.89°F over the shut-in period.

Pressure and temperature measurements were made on ascent at 1,000-foot intervals after concluding the fall-off test period. The average hydrostatic pressure gradient was calculated from these measurements and found to be 0.433 psi/foot, as shown in **Table 3**.

Table 3. Pressure and temperature from stationary gradient survey on 9/14/22.

Station	Time	Depth	Pressure (psig)	Pressure Gradient (psi/ft.)	Temperature (F°)	Temperature Gradient (°F/ft.)
1	8:56 AM	0	570.03		66.80	
2	8:48 AM	1000	981.66	0.412	73.10	0.006
3	8:41 AM	2000	1435.65	0.454	95.33	0.022
4	8:34 AM	3000	1862.04	0.426	109.46	0.014
5	8:27 AM	4000	2328.02	0.466	132.18	0.023
6	8:21 AM	5000	2726.70	0.399	148.68	0.017
7	8:14 AM	6000	3153.46	0.427	171.94	0.023
8	8:06 AM	7000	3582.64	0.429	189.56	0.018
9	7:50 AM	7312	3709.16	0.406	186.79	-0.009
Average Fluid Pressure Gradient				**0.433**	**psi/ft**	

Specifications for the pressure/temperature gauge tool utilized for the 2022 pressure fall-off test are provided in **Table 4. T**he tool calibration file is located in Appendix G.

Table 4. Pressure/temperature gauge specifications.

Manufacturer	Spartek Systems
Model	SS2100
Pressure Range (psi)	0 – 15000
Accuracy	0.05% Full Scale
Resolution	0.0003% Full Scale
Gauge Serial Number	79785
Calibration Date	2/27/2022

3 FALL-OFF ANALYSIS

3.1 PARAMETER ESTIMATION FOR INJECTION INTERVAL AND FLUID PROPERTIES

Table 5 gives parameter estimations used for the WDW No. 2 pressure fall-off analysis. The parameters are based on injection zone characteristics of the Entrada Formation used in previous formation pressure fall-off tests for this well and described in Section 1.3. **Table 6** gives the fluid properties used in the pressure fall-off analysis.

Table 5. Input parameters.

Parameter	Unit	Symbol	Value
Injection Rate	gpm	q	25.56
	BPD	q	876.3
Interval Thickness	Feet	h	123
Final Injection Pressure	psi	P_{wf}	4419.98
Final Shut-in Pressure	psi	P_{si}	3709.16
Final Injection Temperature	°F	$°F_{inj}$	136.89
Final Shut-In Temperature	°F	$°F_{si}$	186.79
Wellbore Radius	feet	r_w	0.3281
Injection Time	hour	t_p	73.41
Shut-in Time	hour	t_{si}	284.09
Formation Porosity	%	ϕ	14.9
Fluid Specific Gravity		ϱ	1.0
Formation Volume Factor	RB/STB	B	1.00

Table 6. Fluid properties.

Parameter	Unit	Symbol	Value
Fluid Viscosity	cp	μ	0.47
Water Compressibility	psi^{-1}	c_w	2.0e-6
Formation Compressibility	psi^{-1}	c_f	2.44e-6
Total Compressibility	psi^{-1}	c_t	4.44e-6

3.2 SEMI-LOG ANALYSIS – HORNER METHOD (CLASSIC)

As noted in **Table 5**, the pressure fall-off portion of the test was monitored for 284.09 hours. **Figure 3** shows the Horner plot of the pressure fall-off data along with the straight line interpreted to be the result of radial flow, which was estimated from 3.274 hours to 12.58 hours into the shut-in period of the test.

Utilizing the straight-line analysis of the radial flow period estimates the initial pressure (P*) 3,734.87 psi. End of wellbore storage was achieved at 0.892 hours (53.52 minutes) into the pressure fall-off period.

The Semi-Log Analysis – Horner Method analysis including equations used, the equations with the appropriate parameters substituted in them, description of values used in calculations and equations and references for values used are described in the **Sections 3.2.1** to **3.2.8**. Analysis results are summarized in **Table 8** in Section 3.6

3.2.1 Flow Capacity

The product of formation permeability (*k*), and injection interval thickness (*h*), in an injection well is referred to as *kh*. Determination of the permeability product is the basis in pressure transient analysis. Calculation for a value for *kh* is obtained from deriving a value for *m*, the slope of the line in psi/log cycle in the radial flow period. The pressure data is shown in **Figure 3** shows the semi-log Horner plot where *m* was estimated at 221.4798 psi/cycle. Flow capacity is then calculated based on an injection rate, a fluid formation volume factor (B) (1.0), and fluid viscosity (μ) (0.47 cp).

The flow capacity (or permeability-thickness product) of the well can be calculated using the following equation:

$$kh = 162.6\frac{q\mu B}{m} md - ft \qquad \text{(Matthews and Russell, Eq. 3.5)}$$

Where: kh = flow capacity of the well (millidarcy-feet) (md-ft)

K = Effective formation permeability, millidarcies (md)

q = Injection rate during the test

B = Formation volume factor, reservoir barrel per stock tank barrel (RB/STB)

μ = Viscosity of injected fluid at reservoir temperature, centipoise (cp)

m = Slope of the radial flow transient portion of Horner Plot (psi/log cycle)

h = Net formation thickness, (ft.)

For this test (from **Figure 3**):

q = 876.3 bbls/day = 25.56 gpm

m = 221.4798 psi

h = 123 feet

μ = 0.47 cp (After Matthews & Russell, data of Chestnut)

Therefore:

$$kh = 162.6\frac{(876.3)(0.47)(1.00)}{221.4797} md - ft$$

$$kh = 302\ md - ft$$

3.2.2 Permeability

Using the calculated flow velocity (*kh*) and solving for permeability by dividing the 525 feet of Arbuckle thickness gives:

$$k = \frac{302\ md - ft}{123\ ft}$$

$$k = 2.46\ md$$

3.2.3 Transmissivity

Transmissivity is the ratio of flow capacity of an injection fluid over the viscosity of the injection fluid transmitted through a porous media.

The transmissivity of the well can be calculated by the following equation:

$$T = \frac{kh}{\mu}$$

Where;	T	=	transmissivity of well, md-ft./cp
	kh	=	flow capacity of well md-ft.
	μ	=	viscosity of injected fluid at reservoir temperature, cp
For this test:	kh	=	302 md-ft.
	μ	=	0.47 cp

Solving for transmissivity:

	T	=	643 md-ft/cp

3.2.4 Initial Reservoir Pressure

Extrapolated pressure (P*) of the straight-line portion of the Horner Plot to the shut-in of Horner time (10^0) gives an indication of the initial reservoir pressure:

	P^*	=	3,734.40 psi at 7,312 ft. bgs (*see **Figure 3***)

3.2.5 Skin Factor

The conventional skin equation utilized below assumes that the well is completed over the entire interval.

$$S = 1.151\left[\left(\frac{(P_{wf} - P_{1hr})}{m}\right) - log\left(\frac{k}{\varphi\mu c_t r_w^2}\right) + 3.23\right] \qquad \text{(Matthews and Russell, Eq. 3.10)}$$

Where:	S	=	Skin factor
	P_{1hr}	=	Pressure on straight line portion of Horner Plot at Δt = 1 hour
	P_{wf}	=	Pressure observed while injecting prior to shut-in
	μ	=	Formation porosity, percent (14.9%, same as previous tests)

c_t = Total system compressibility (psi^{-1})

r_w = Wellbore radius, ft.

From test data:

P_{wf} = 4,419.98 psi

P_{1hr} = 4,167.60 psi (**Figure 4**)

m = 221.4797 psi/cycle

k = 2.46 md

ϕ = 0.149

μ = 0.47 cp

c_t = $4.44e^{-6}$ psi^{-1}

r_w = 0.3281 ft.

Therefore: $$S = 1.151\left[\left(\frac{(4{,}419.98-4{,}167.60)}{221.4797}\right) - log\left(\frac{2.46}{(0.149)(0.47)(4.44e^{-6})(0.3281^2)}\right) + 3.23\right]$$

$$S = -4.024$$

The resulting skin factor is -4.024. A negative skin factor (S<0) suggests flow conditions near the wellbore are enhanced.

3.2.6 Pressure Drop Due to Skin

Pressure drop across the skin at a rate (q) may be calculated by means of the following equation:

$$\Delta P_{skin} = 141.2\frac{qB\mu}{kh}s \qquad \text{(Earlougher, Eq. 2.9)}$$

Where: ΔP_{skin}= Change in pressure due to skin factor

From the test data:

q = 876.3 bbls/day

B = 1.00

μ = 0.47

kh = 302 md-ft

S = -4.024

Therefore: ΔP_{skin} = -774.02 psi

3.2.7 Flow Efficiency

The flow efficiency of the well (expressed as a percentage) is evaluated from the pressure fall-off data and is calculated using the following equation:

$$F_{eff} = \left(\frac{(P_{wf} - P_{av} - \Delta P_{skin})}{(P_{wf} - P_{av})}\right)$$ (Matthews and Russell, Eq. 3.12)

Where: P_{av} = Average reservoir pressure at gauge depth (P* in this case)

From the test data:

P_{wf} = 4,419.98 psi

P_{av} = 3,734.40 psi

ΔP_{skin} = -774.02 psi

Therefore: $F_{eff} = \left(\frac{(4{,}419.98 - 3{,}734.40 - (-774.02))}{(4{,}419.98 - 3{,}734.40)}\right)$

$F_{eff} = 2.129$

3.2.8 *Drainage Area (Radius of Test Investigation)*

The radius of investigation, R_{inv}, is the distance a pressure transient has moved into a formation following a rate change in a well. The lateral extent that the reservoir test has covered can be calculated as follows:

$$R_{inv} = \sqrt{\frac{kt}{948\varphi\mu c_t}}$$ (Lee, Eq 1.47)

Where: R_{inv} = radius of investigation, feet

t = Time after shut-in (end of radial flow, **Figure 3**, 12.59 hours)

From the test data:

k = 2.46 md

t = 12.59 hrs.

ϕ = 0.149

μ = 0.47 cp

c_t = $4.44e^{-6}$ psi^{-1}

Therefore: R_{inv} = 289 feet

3.3 WASTE FRONT DISTANCE

The travel time for a pressure transient to pass beyond the waste front was calculated to determine whether the viscosity utilized was valid. The radius of influence (R_{inv}) distance from the Horner Plot (Figure 3) was estimated to be from 3.274 to 12.58 hours, which equates to a radius distance of 148 and 289 feet respectively.

OCD Guideline Section VIII.5 states that calculating the travel time for a pressure transient to pass beyond the waste front may be necessary. The distance to the waste front is determined from the following equation:

$$R_{waste} = \left(\frac{0.13368\,V}{\pi\,h\,\varphi}\right)^{\frac{1}{2}}$$

where,

R_{waste} = radius to waste front, feet

V = total volume injected into the injection interval, gallons

h = formation thickness, feet

ϕ = formation porosity, fraction

0.13368 = constant

$$R_{waste} = \left(\frac{(0.13368)(9{,}089{,}116)}{(\pi)(123)(0.149)}\right)^{\frac{1}{2}}$$

R_{waste} =145.2 feet

The estimated distance to the waste front is 145.2 feet.

3.4 WASTE FRONT TIME

The time necessary for a pressure transient to traverse this distance is calculated from the following equation:

$$t_{waste} = 948\left(\frac{\varphi\,\mu_{waste}\,c_t\,r_{waste}^2}{k}\right)$$

where,

t_{waste} = time for pressure transient to reach waste front, hours

ϕ = formation porosity, fraction

μ_{waste} = viscosity of the waste at reservoir conditions, centipoise

r_{waste} = radius to waste front, feet

c_t = total compressibility of the formation and fluid, psi

k = formation permeability, millidarcies

948 = constant

$t_{waste} = 948\left(\frac{(0.149)\,(0.47)(4.44e^{-6})(145.2^2)}{2.46}\right)$

t_{waste} = 2.53 hours

The time required to reach the waste front is 2.53 hours, which is less than the time of 3.274 hours or the beginning of the radial flow period estimated in the Horner Plot (Figure 3).

3.5 HOMOGENEOUS TYPE-CURVE (LOG-LOG) MODEL ANALYSIS

In addition to the classical analysis described above, the test response was analyzed using a derivative analysis. The test data was analyzed using PIE, from Well-Test Solutions, Ltd., a well-test analysis software program commercially available for pressure transient analysis used in the oil and gas industry.

The log-log plot is used to identify flow regimes and get estimates for permeability, skin, and wellbore storage. The log-log plot analyzes both the change in log pressure (ΔP) during a given flow period and the log derivative of pressure over rate related to the change in log time (Δt). The derivative function is graphed on the log-log plot and is used to identify flow regimens, boundary effects, layering, or natural fractures. Using this approach allows flow regimes and boundaries to be identified. Use of the derivative plot for pressure fall-off test analysis is further described by Bourdet, 2002.

The type-curve model selected for analyzing the data in the log-log plot is a homogeneous reservoir with infinite radial flow geometry. The use of an analytical analysis program allows a comparison between the classical method described above and a derivative analysis of the data using a homogeneous type-curve model analysis.

The derivative plot model type-curves were derived from an iterative process in the PIE software matching the pressure fall-off responses with the infinite acting homogeneous model. The blue line (ΔP) and red line (derivative) are the homogeneous model, type-curve (best fit) model responses on the plot **(Figure 6)**. The derivative plot type-curves exhibit the characteristics of a homogeneous, infinite-acting, radial-flow-dominated reservoir.

The log-log pressure plot with type-curve matching model of the 2022 pressure fall-off test is shown in **Figure 6.** The ΔP type-curve was reasonably matched to the pressure change (ΔP) data for the transition phase from wellbore storage to radial flow. Radial flow developed shortly after the end of wellbore storage. The type-curve match in this period agrees relatively well with the radius of investigation for radial flow analysis in the Horner Plot (**Figure 3**).

The late-time upturn in the derivative data plot is indicative of a boundary condition of decreasing mobility away from the wellbore. This boundary condition develops following the radial flow period. The boundary condition is likely a result of decreasing permeability at a given distance from the wellbore.

The model predictions are also compared to the superposition plot (**Figure 7**). The superposition plot is more generalized equivalent to the Horner plot. The type-curve match to the data was reasonably correlated to the radial flow period identified in the Horner plot.

Pressure plot is shown in **Figure 8** showing pressure versus time with type-curve match.

Analysis using the predictive model generally provides the same permeability thickness and extrapolated pressure (P*) as calculated in the classical analysis results. The results for the straight-line analysis (Horner) and homogeneous model derivative response are summarized in **Table 9**.

3.6 RESULTS SUMMARY

The following tables summarize the results of the pressure fall-off test measurements and calculations.

Table 7. Semi-Log Analysis, Horner Method (Classic)

Parameter	Unit	Symbol	Result
Transmissivity	md-ft/cp	T	643
Flow Capacity	md-ft	kh	302
Permeability	md	k	2.46
Skin Factor	(unitless)	S	-4.026
Pressure Drop Due to Skin	psi	ΔP_{skin}	-774.35
Flow Efficiency	%	F_{eff}	213.03
Radius of Investigation (distance)	feet	R_{inv}	289
Radius of Investigation (time)	hour	Δt	12.58
Semi-Log Slope	psi/cycle	m	221.4798
Extrapolated Pressure	psi	P*	3,734.87
Extrapolated Pressure @ 1-hour	psi	$P1hr$	4,167.60

Table 8. Homogenous Type-Curve (Log-Log) Model Analysis

Parameter	Unit	Symbol	Result
Transmissivity	md-ft/cp	T	559
Flow Capacity	md-ft	kh	263
Permeability	md	k	2.13
Initial (Extrapolated) Pressure	psi	p_i	3696.86
Skin Factor	(unitless)	S	-4.264
Pressure Drop Due to Skin	psi	ΔP_{skin}	-944.41
Flow Efficiency	%	F_{eff}	230.60
Wellbore Storage	bbls/psi	C	.00176
Radius of Investigation (distance)	feet	R_{inv}	269
Radius of Investigation (time)	hour	Δt	12.58

Table 9. Comparison with previous fall-off tests.

Date of Test	Permeability (md)	Mobility-Thickness (kh/u)(md-ft/cp)	Skin (s)	False Extrapolated Pressure (p*)
10/3/17 – 10/13/17	3.30	1108	-5.37	3819
4/15/19 – 4/30/19	1.73	451	-3.80	3809.70
9/21/20 – 10/1/20	1.14	297.64	-5.05	3632.37
9/19/21 -9/29/21	1.03	269.75	-5.12	3735.42
9/14/22 -9/26/22	2.46	643	-4.03	3734.40

4 CONCLUSIONS

4.1 DISCUSSION OF RESULTS

This test was successful in generating sufficient pressure buildup and falloff data to complete a meaningful analysis of the injection well. A clear radial flow regime, or infinite acting period, is observed in the data. The classical Semi-Log, Horner analysis and the Log-Log analysis provided consistent calculations of wellbore and reservoir injection parameters. A late-time upturn in the derivative data indicates a boundary condition of decreasing mobility away from the wellbore.

The measured permeability, mobility thickness, skin, and false extrapolated pressure from the subject fall-off test are consistent with previous tests. The measured well performance and observed well health is consistent with the initial 2017 fall-off test conducted on the well. The injectivity is consistent with the nearby Ashcroft SWD #001 well, based on reported historical monthly volumes. The injection rates and pressure are within the expected range for disposal into the Entrada sandstone at this depth.

4.2 RECORD KEEPING

The raw test data generated by the test will be kept on file by the permittee (Western Refining Southwest LLC) for a period of not less than 3 years and will be made available to OCD upon request during this time period. The raw test data need not be submitted to OCD unless requested.

5 REFERENCES

Bourdet, Dominique, 2002, "Well Test Analysis: The Use of Advanced Interpretation Models" Amsterdam: Elsevier

Earlougher, Robert C., 1977, "Advances in Well Test Analysis", Monograph Series, Society of Petroleum Engineers, Dallas, Vol. 5

Lee, John, 1982, "Well Testing", SPE Textbook Series Vol. 1

Matthews, C.S. and Russell, D.G., 1967, "Pressure Buildup and Flow Tests in Wells", Monograph Series, Society of Petroleum Engineers, Dallas, Vol. 1

New Mexico Oil Conservation Division, 2007, "UIC Class I Well Fall-Off Test Guidance"

6 APPENDICES

APPENDIX A. FIGURES

APPENDIX B. TEST FIELD REPORT

APPENDIX C. INJECTION DATA

APPENDIX D. COPY OF ELECTRIC LOG

APPENDIX E. AREA OF REVIEW TABLE

APPENDIX F. INJECTION AND FORMATION FLUID ANALYSIS

APPENDIX G. TOOL CALIBRATION

APPENDIX A. FIGURES

Figure 1. Well Completion Schematic

Figure 2. Pressure and Rate History

Figure 3. Horner Plot

Figure 4. Expanded Horner Plot

Figure 5. Pressure and Temperature vs. Time Plot over the Test Period

Figure 6. Log-Log Plot

Figure 7. Superposition Plot

Figure 8. Pressure versus Time Plot

Figure 9. Cartesian Plot

Figure 10. Static Pressure Gradient Survey

Figure 11. Area of Review Map

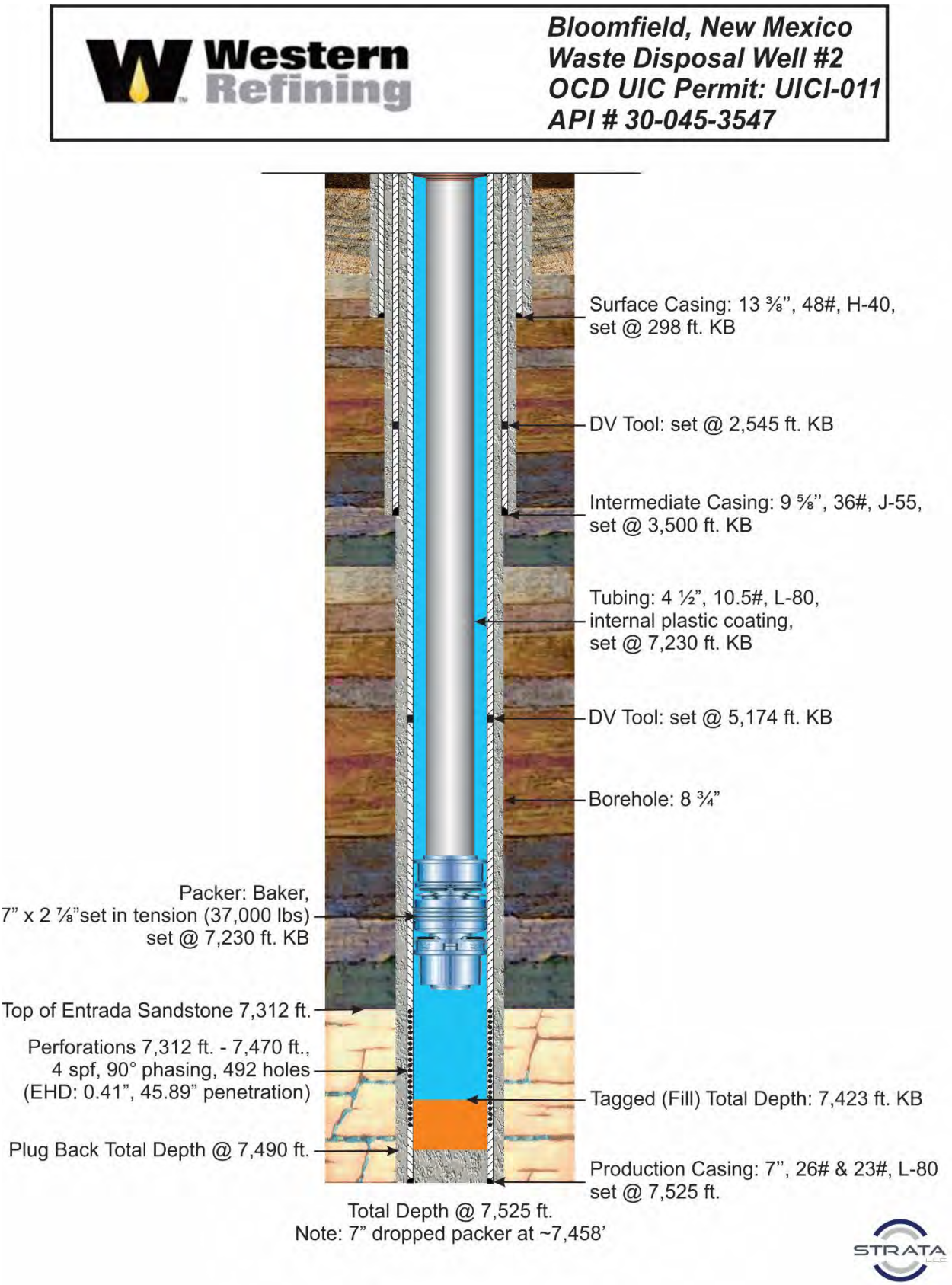
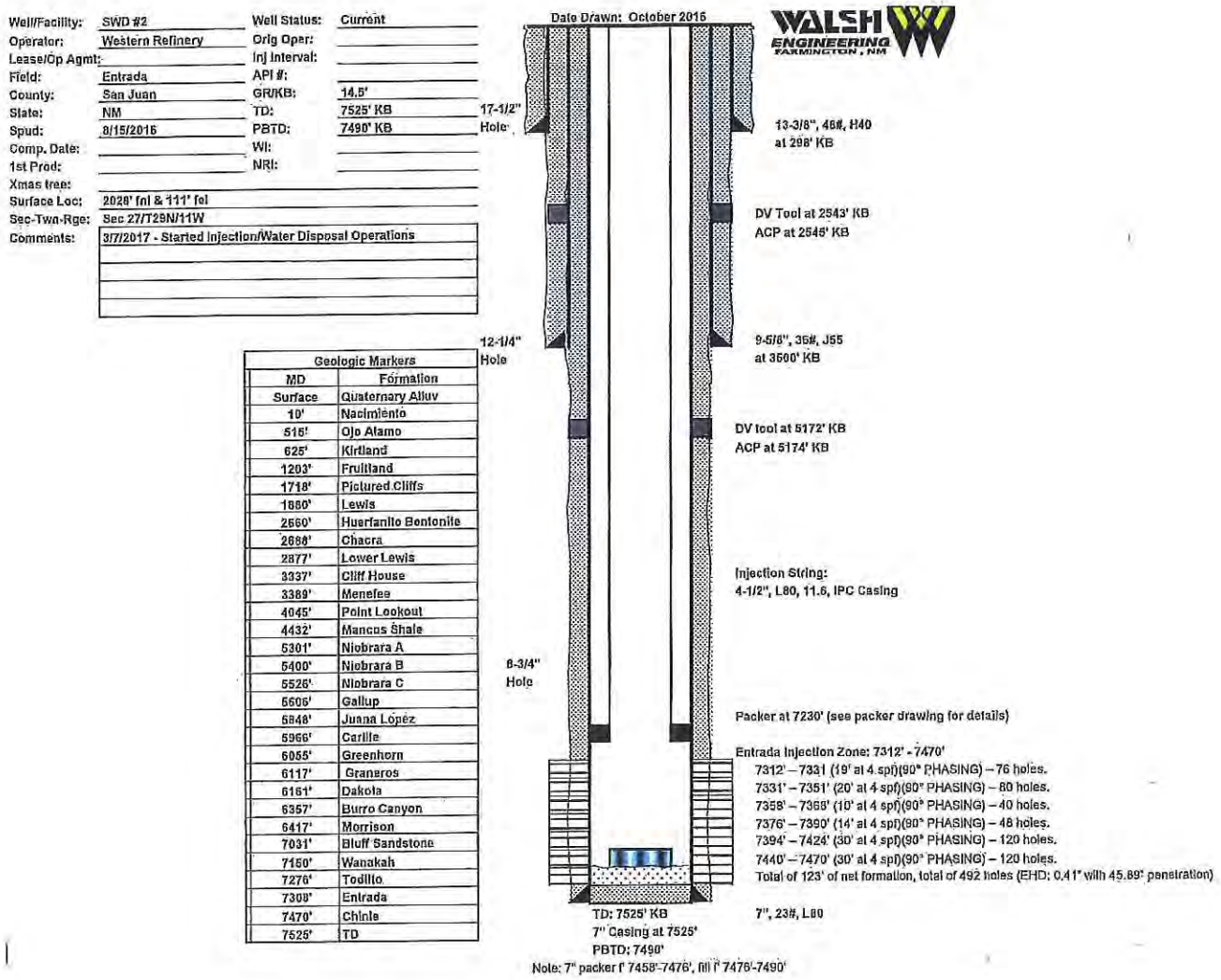


Figure 1a – Updated Well Completion Schematic

FIGURE 1



Geologic Markers	
MD	Formation
Surface	Quaternary Alluv
10'	Nacimiento
515'	Ojo Alamo
625'	Kirtland
1203'	Fruitland
1718'	Pictured Cliffs
1850'	Lewis
2660'	Huerfanito Bentonite
2688'	Chacra
2877'	Lower Lewis
3337'	Cliff House
3389'	Menefee
4045'	Point Lookout
4432'	Mancos Shale
5301'	Niobrara A
5400'	Niobrara B
5526'	Niobrara C
6606'	Gallup
6848'	Juana Lopez
5966'	Carlile
6055'	Greenhorn
6117'	Graneros
6161'	Dakota
6357'	Burro Canyon
6417'	Morrison
7031'	Bluff Sandstone
7150'	Wanakah
7276'	Todilto
7308'	Entrada
7470'	Chinle
7525'	TD

Figure 1b – Original Well Completion Schematic

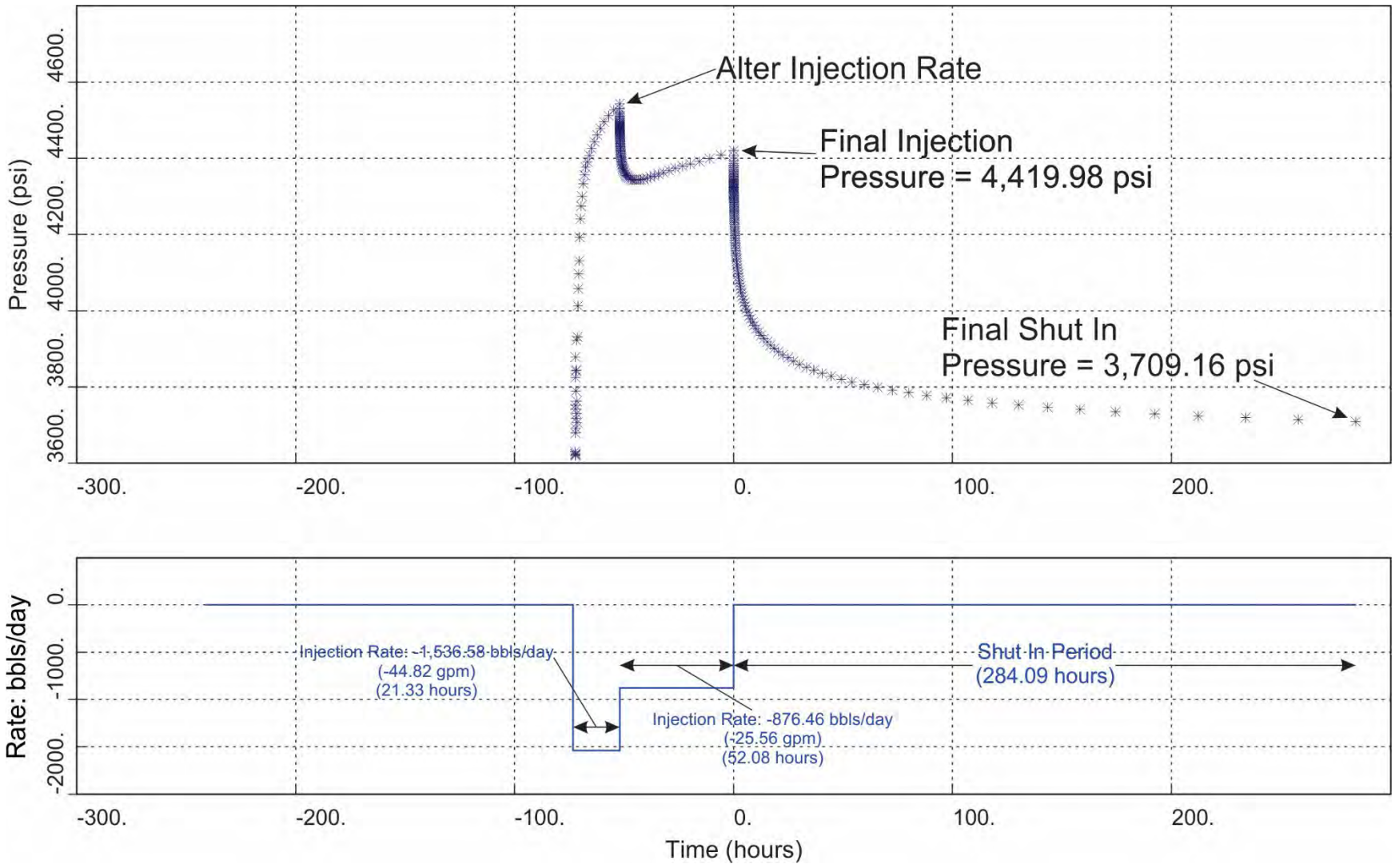
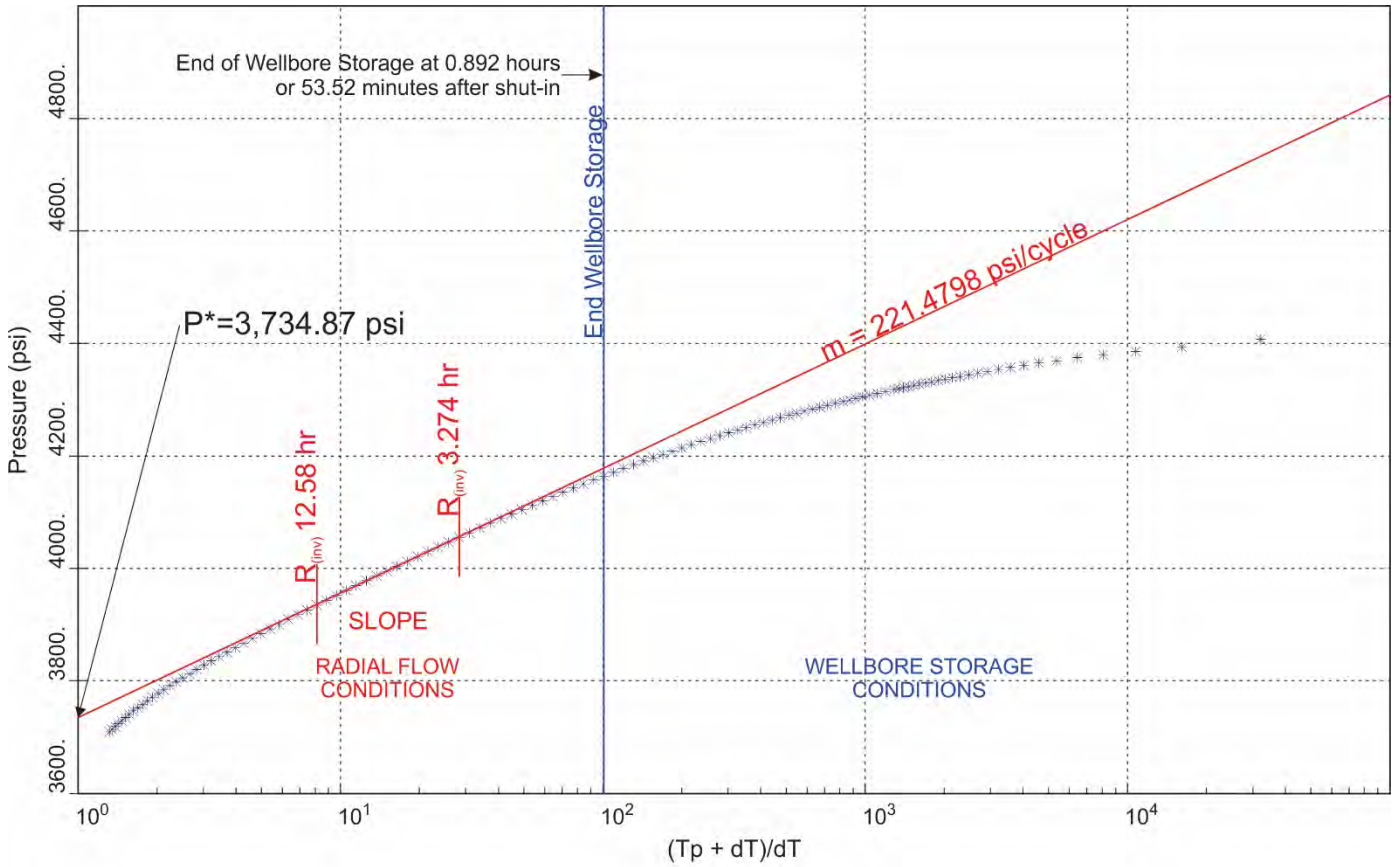


Figure 2 – Pressure and Rate History



Slope = 221.4798 psi/cycle
P* = 3,734.87 psi
R(inv) at 3.274 hr = 148 feet
R(inv) at 12.58 hr = 289 feet

Skin = -4.026
Permeability = 2.46 md
Perm-Thickness = 302.38 md-feet

Static-Data and Constants

Volume-Factor = 1.000 vol/vol
Thickness = 123 feet
Viscosity = 0.47 cp
Total Compressibility = 4.44e-06 psi^{-1}
Rate = -876.3 bbls/day
Storativity = 0.00008137 feet psi^{-1}
Diffusivity = 2,085 ft^2/hr
Gauge Depth = 7,312 feet

Figure 3 –Horner Plot

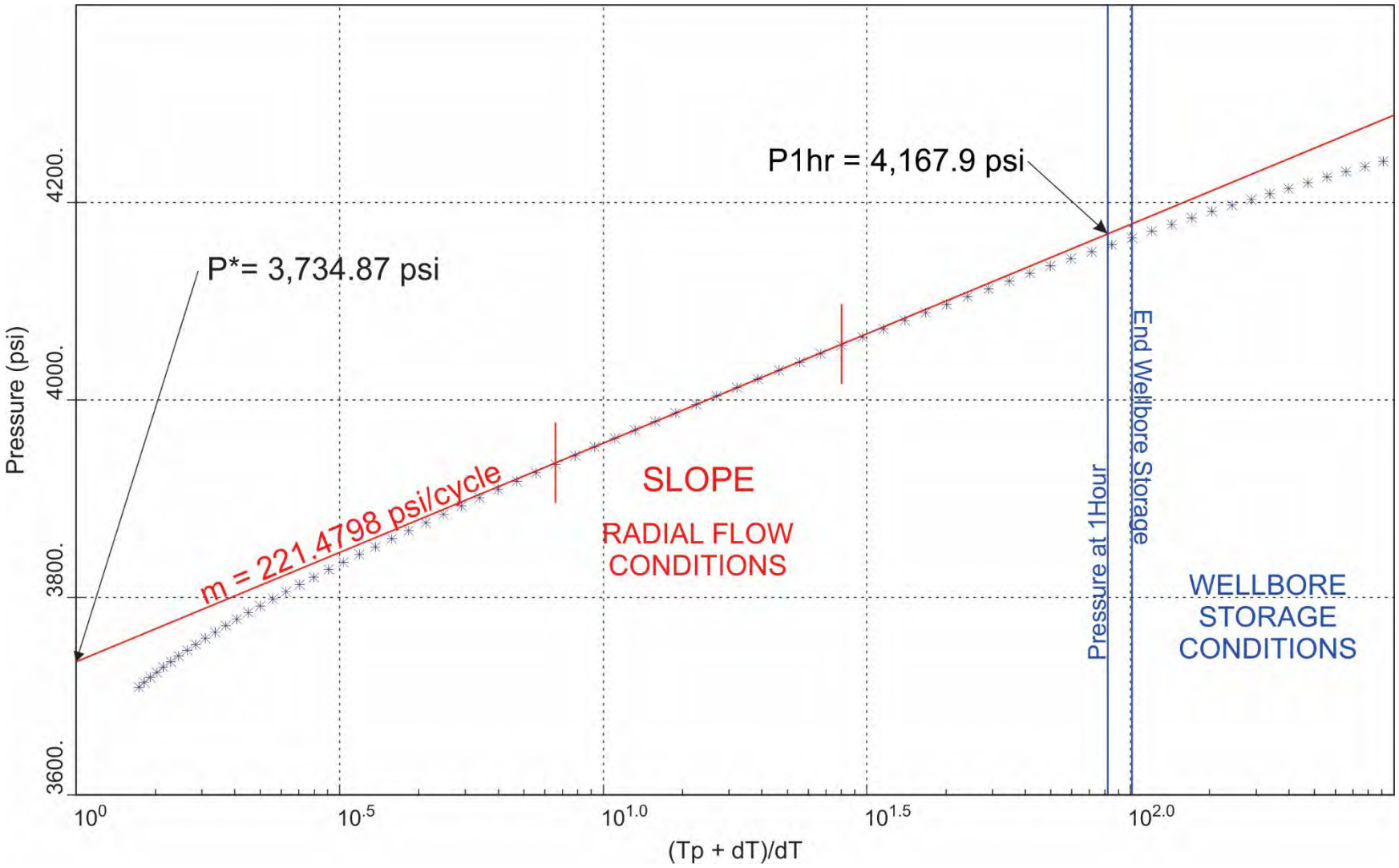


Figure 4 –Expanded Horner Plot

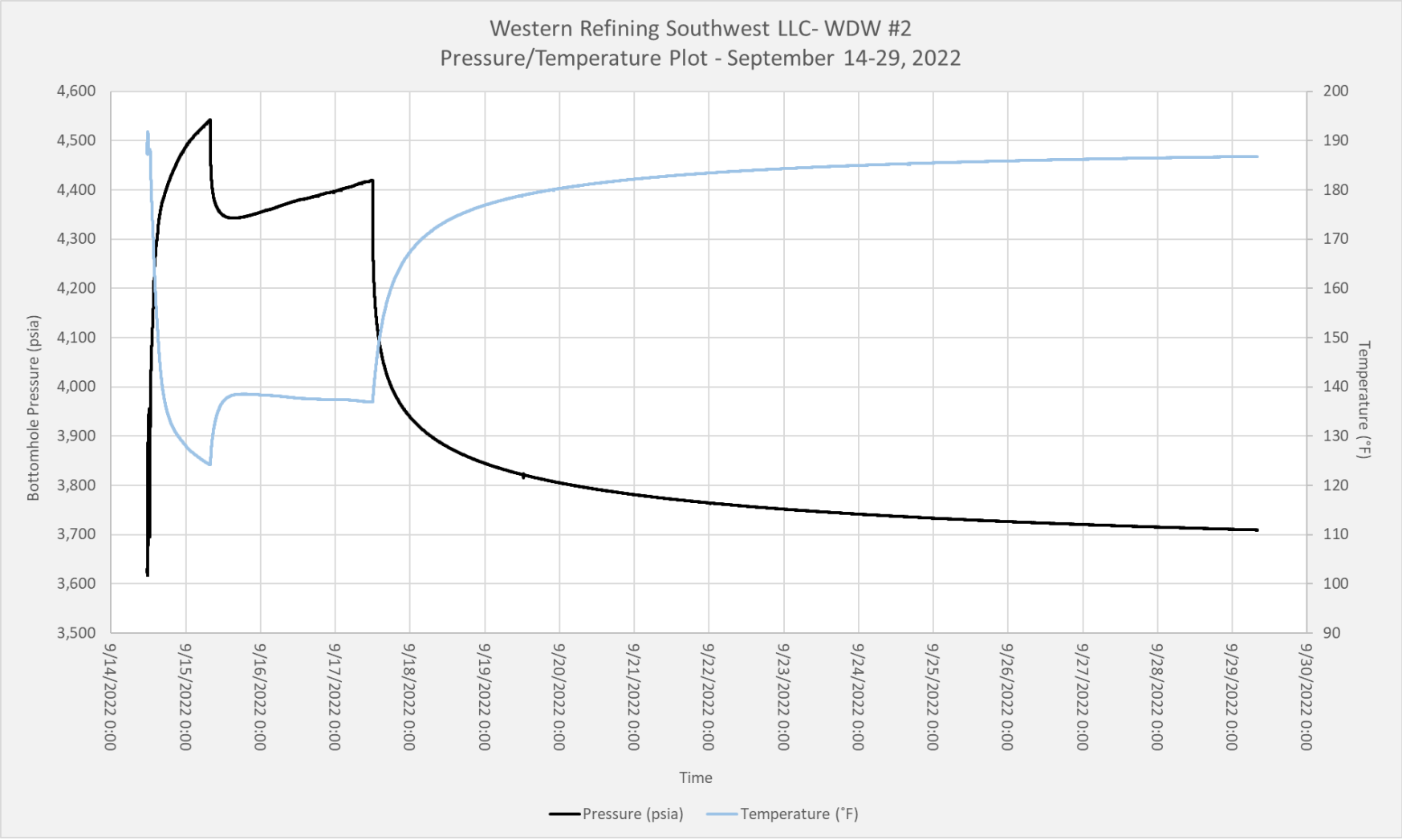
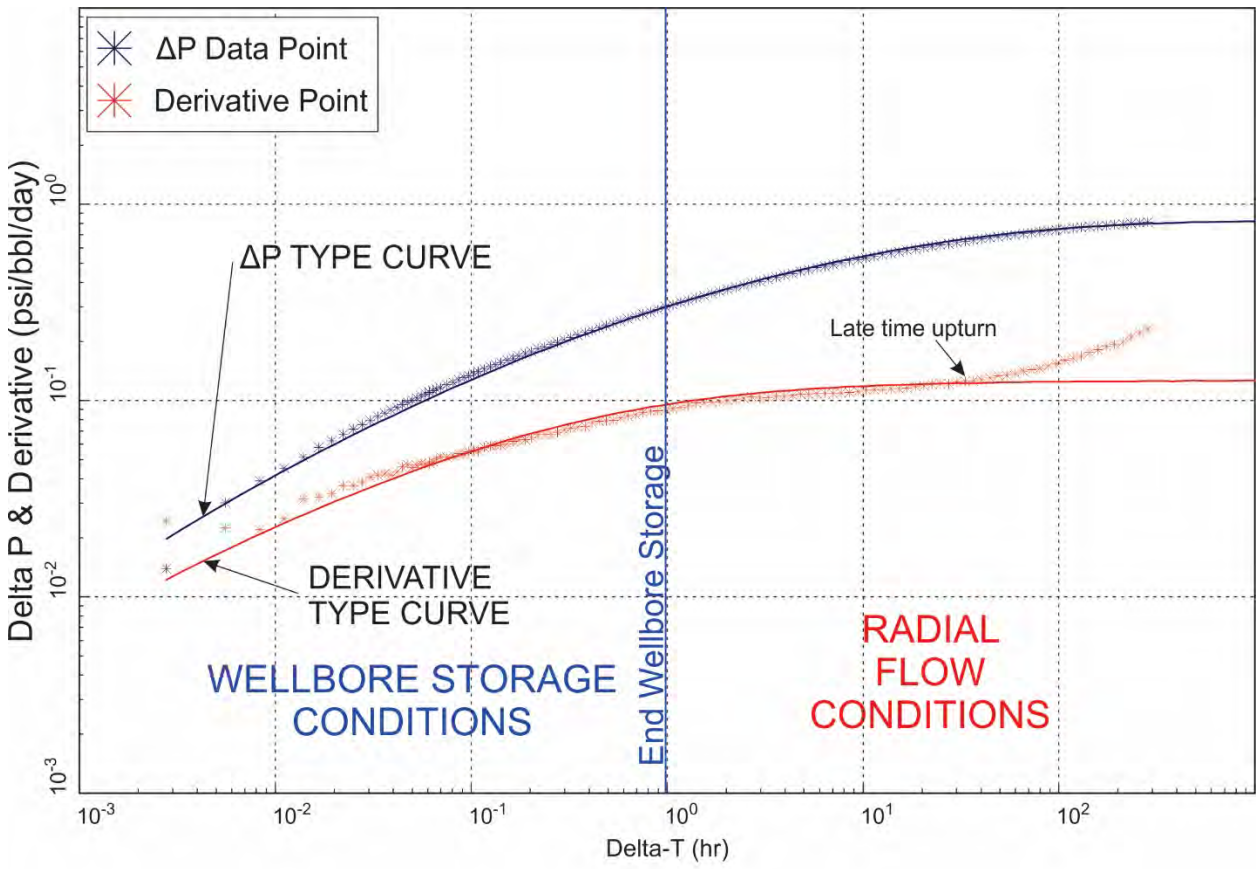


Figure 5 – Pressure and Temperature vs. Time Plot over the Test Period



Homogeneous Reservoir

** Simulation Data **
Well storage = 0.0017565 bbls/psi
Skin = -4.2635
Permeability = 2.1346 md
Areal Ky/Kx = 1.0000
Perm-Thickness = 262.55 md-feet
Initial Press. = 3,696.86 psi
Smoothing Coef = 0, 0

Static-Data and Constants

Volume-Factor = 1.000 vol/vol
Thickness = 123 feet
Viscosity = 0.47 cp
Total Compress = $4.44e^{-6}$ psi^{-1}
Rate = -876.5 bbls/day
Storativity = 0.00008127 feet psi^{-1}
Diffusivity = 1,810 ft^2/hr
Gauge Depth = 7,312 feet

Figure 6 – Log-Log Plot

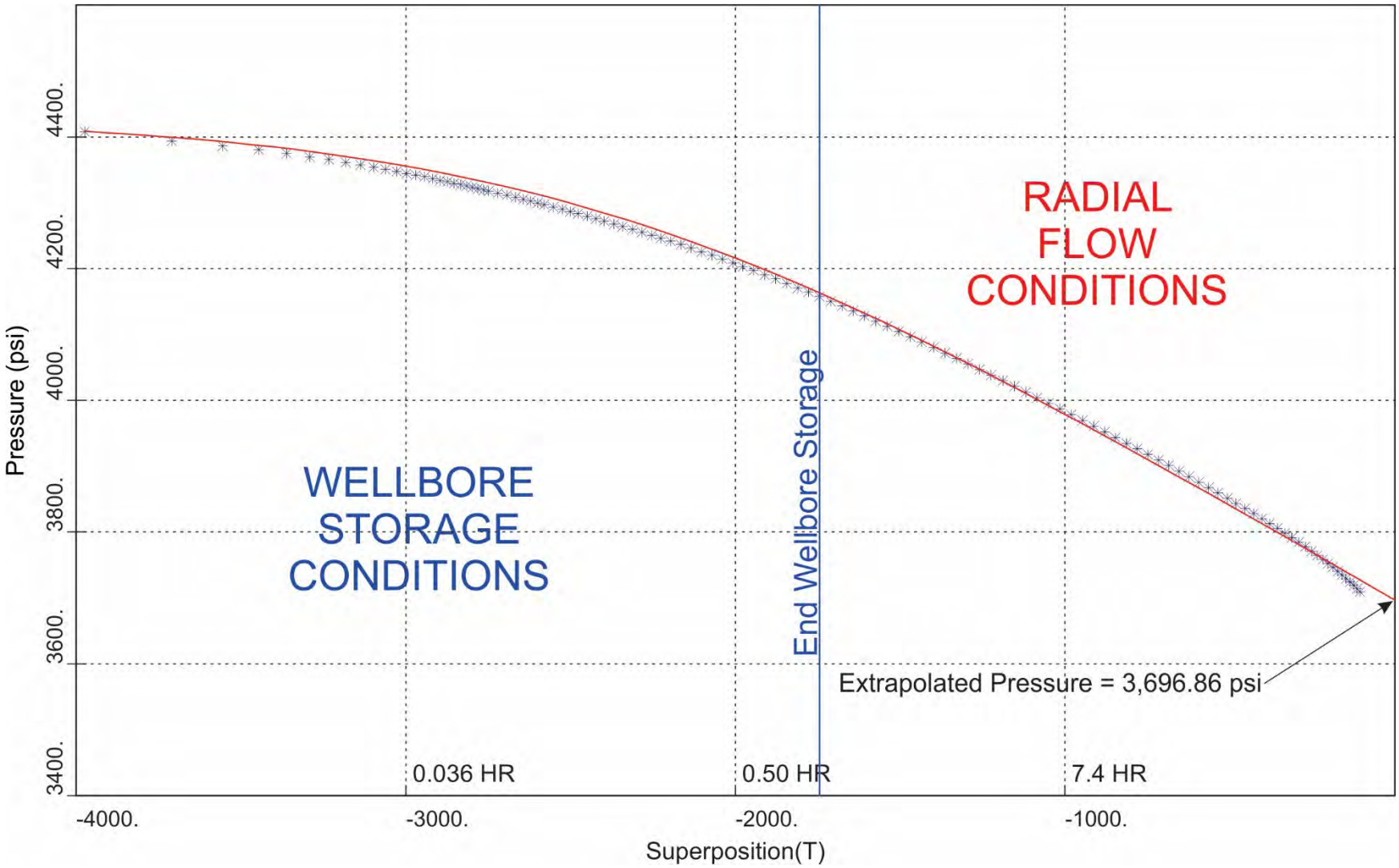


Figure 7 – Superposition Plot

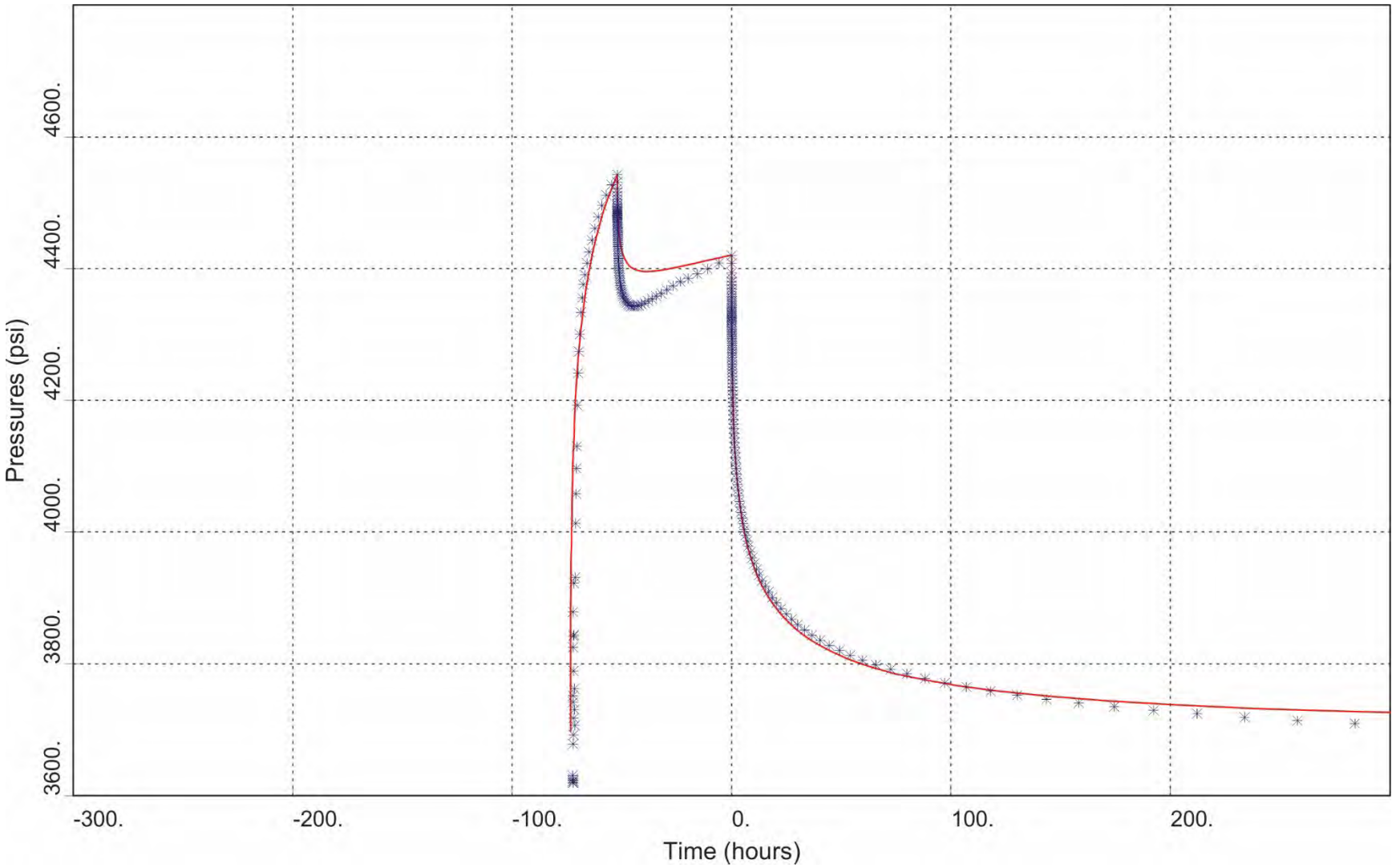


Figure 8 – Pressure versus Time Plot

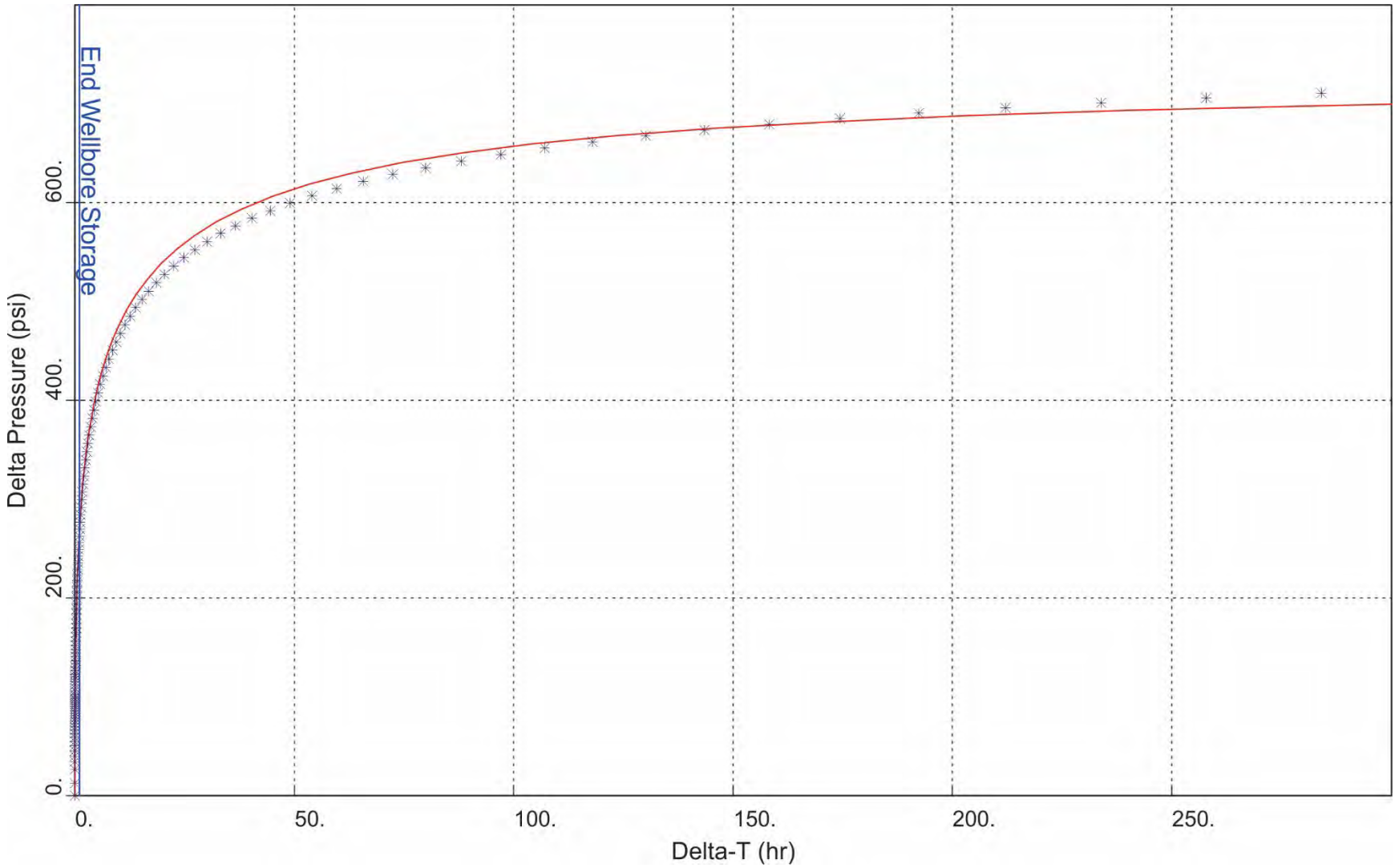


Figure 9 – Cartesian Plot

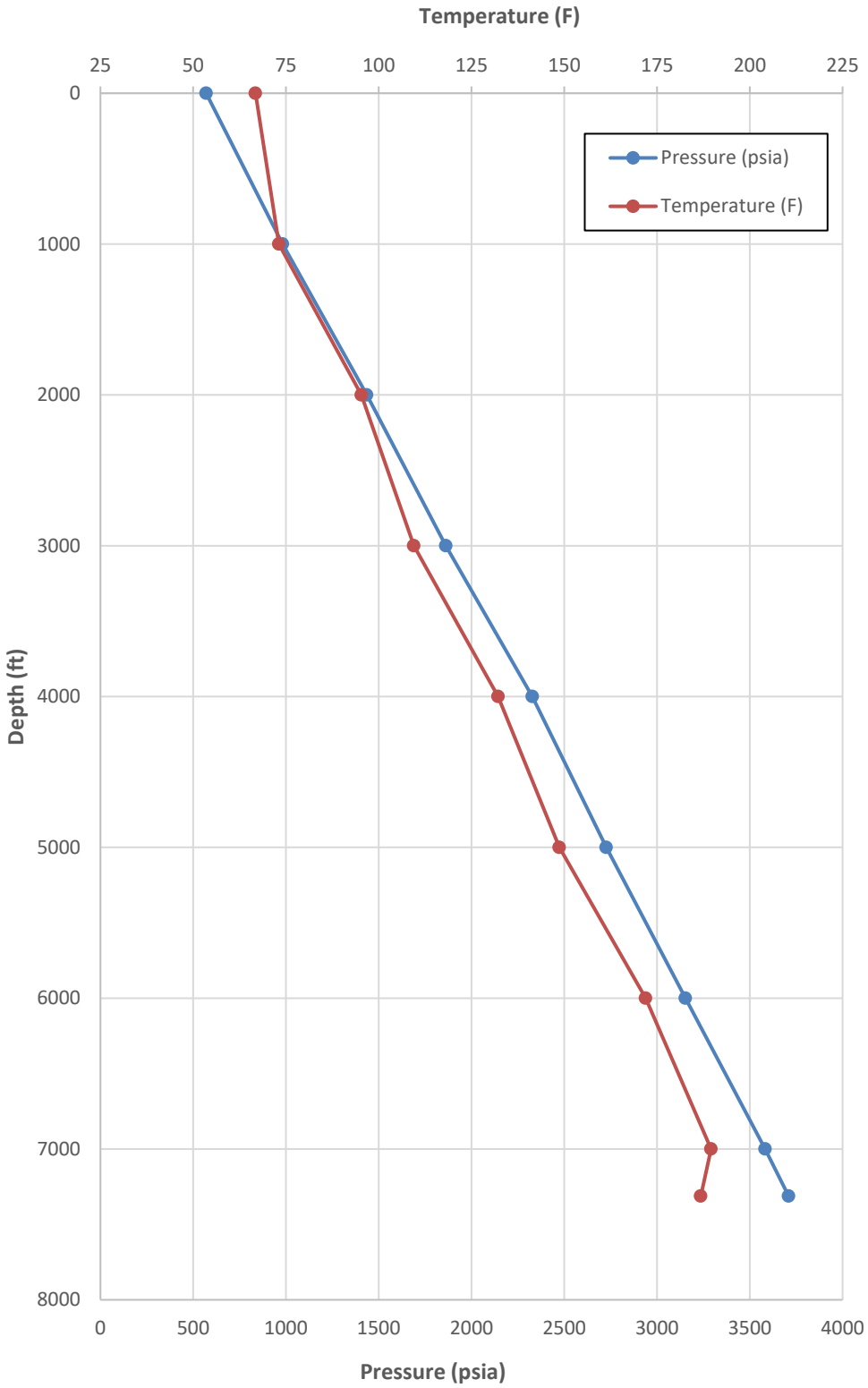


Figure 10 – Static Pressure Gradient Survey

STRATA

OCD Well Locations

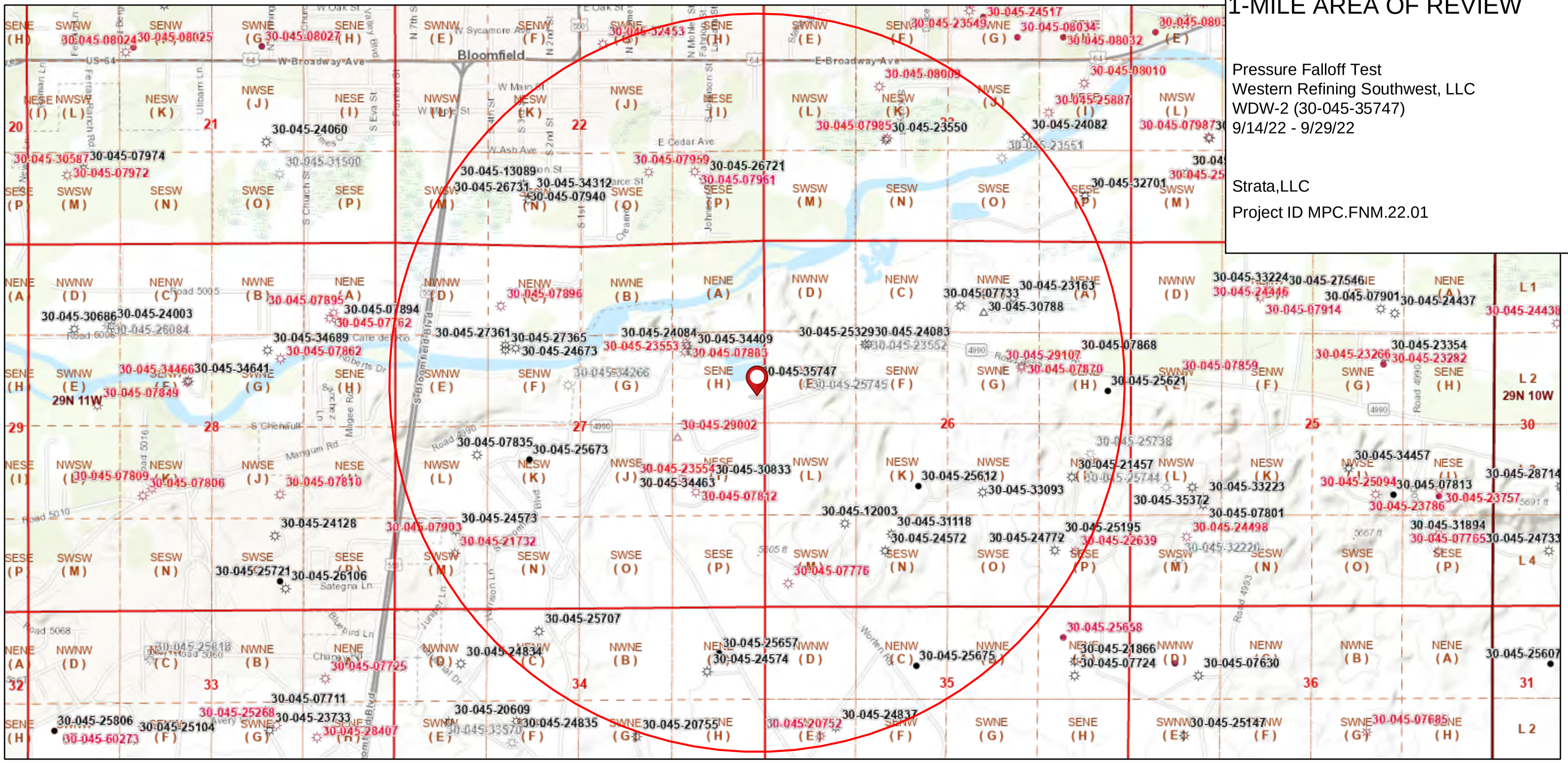
FIGURE 11

1-MILE AREA OF REVIEW

Pressure Falloff Test
Western Refining Southwest, LLC
WDW-2 (30-045-35747)
9/14/22 - 9/29/22

Strata,LLC

Project ID MPC.FNM.22.01



10/14/2022, 3:45:15 PM

Wells - Large Scale

- Gas, Active
- Gas, Cancelled
- Gas, Plugged
- Oil, Active
- Oil, Plugged
- Salt Water Injection, Active
- Salt Water Injection, Plugged
- Water, Plugged
- PLSS Second Division
- PLSS First Division
- PLSS Townships

1:20,876

0 0.17 0.35 0.7 mi

0 0.3 0.6 1.2 km

Oil Conservation Division of the New Mexico Energy, Minerals and Natural Resources Department., San Juan County, NM, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, METI/NASA, EPA, USDA, BLM

New Mexico Oil Conservation Division
NM OCD Oil and Gas Map. http://nm-emnrd.maps.arcgis.com/apps/webappviewer/index.html?id=4d017f2306164de29fd2fb9f8f35ca75: New Mexico Oil Conservation Division

APPENDIX B. TEST FIELD REPORT

TEST FIELD REPORT						
Operator: Western Refining	Strata Test Supervisor		Brandon Schulte			
Waste Disposal Well No. 2	Strata Project No.		MPC.FNM.22.01		API No.	30-045-35747
NOTE	TIME	TUBING PRESSURE	CASING PRESSURE	INTER. PRESSURE	BHF PRESSURE	INJECTION RATE
	24-HR	psig	psig	psig	psig	gpm
9/14/2022						
Arrive at site, safety orientation, get work permit	7:00					0
Arrive at well, take initial readings	8:00	488.0				
- Top WL connection under cap is 4" LTC						
NM OCD John Durham arrives	8:35					
Stand up lubricator, zero depth @ tubing hanger	8:45					
- Tubing hanger 1.5' from GL						
- RKB 14.5' GL = 13' correction						
Finish rigging up, PIT connected to lubricator	9:30					
- PIT later moved to WH TEE after WL BOP closed						
Start BHF Test - Initial Reading	9:36	477.0	32.0	96.0	28.0	0.0
Open BHF Valve - Gas, Quick Bleed-off	9:37		34.0	96.0	0.0	0.0
BHF Test - 5 Minute Reading	9:42:00		34.0	96.0	0.0	0.0
BHF Test - 10 Minute Reading	9:47:00	483.0	34.0	96.0	0.0	0.0
BHF Test - 15 Minute Reading	9:52:00	483.0	34.0	96.0	0.0	0.0
Open Intermediate Casing Valve - Gas, <1 minute, then 0	10:00:00		34.0	0.0	0.0	
Intermediate Test - 5 Minute Reading	10:10:00		34.0	1.0	0.0	
Intermediate Test - 10 Minute Reading	10:15:00		34.0	0.0	0.0	
Intermediate Test - 15 Minute Reading	10:20:00	484.0	34.0	0.0	0.0	
Start in hole w/ impression block to tag TD	10:25:00					
Tag TD @ 7423' RKB (7410' slickline mesurement)	10:37:00					
Change to PT tool, start tool	11:14:00					
Start in hole with downhole gauge	11:19:00					
Stop gauge at 7312' KB (7299' slickline measurement)	11:32:00					
Start injection	11:40:00	537.0				40-45
Take reading	11:59:00					
Trouble shoot pump - move PIT from lubricator to WH Tee	12:28:00					
Resume injection	12:48:00	800.0				40-45
Demobilize	1:00:00					
9/15/2022						
Lower injection rate to 25 gpm	8:00:00	1370.0				25.0
9/17/2022						
Shut in well.	11:56:00	1242.3				0.0
9/29/2022						
Arrived at location	6:30:00					
Held Tailgate Safety Meeting, Site Safety video	7:00:00					
Received permit travel to well location	7:30:00					
Began coming out of well using procedure	7:45:00					
Completed Gradient stops, tool at surface	9:49:00					
Rig down slickline equipment						
Return well to Marathon. All off location	10:30:00					

APPENDIX C. INJECTION DATA

Western Refining Southwest, LLC

WDW-2

Table 1. Monthly Injected Volumes

Month	Monthly Total (gpm)
Oct-21	4,410
Nov-21	0
Dec-21	2,226
Jan-22	1,051
Feb-22	0
Mar-22	16,632
Apr-22	126
May-22	3,066
Jun-22	0
Jul-22	42
Aug-22	0
Sep-22	137,787
Total	**165,340**

Table 2. Daily Volumes, Month of Falloff Test

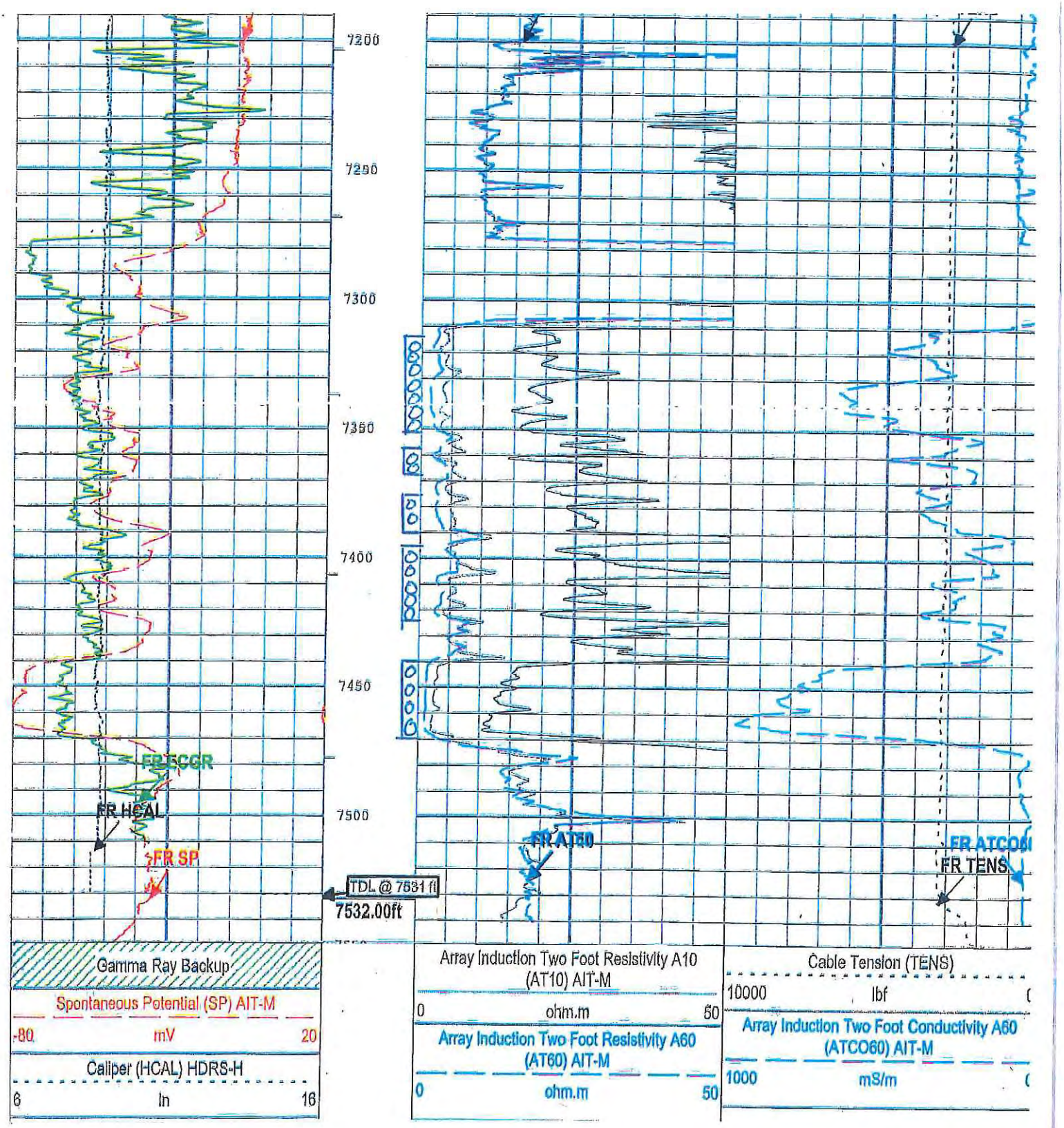
Date	Cumulative Vol.
9/1/2022	0
9/2/2022	0
9/3/2022	0
9/4/2022	0
9/5/2022	0
9/6/2022	0
9/7/2022	4,665
9/8/2022	4,665
9/9/2022	4,665
9/10/2022	4,665
9/11/2022	4,665
9/12/2022	4,655
9/13/2022	4,655
9/14/2022	36,788
9/15/2022	82,775
9/16/2022	119,596
9/17/2022	137,787

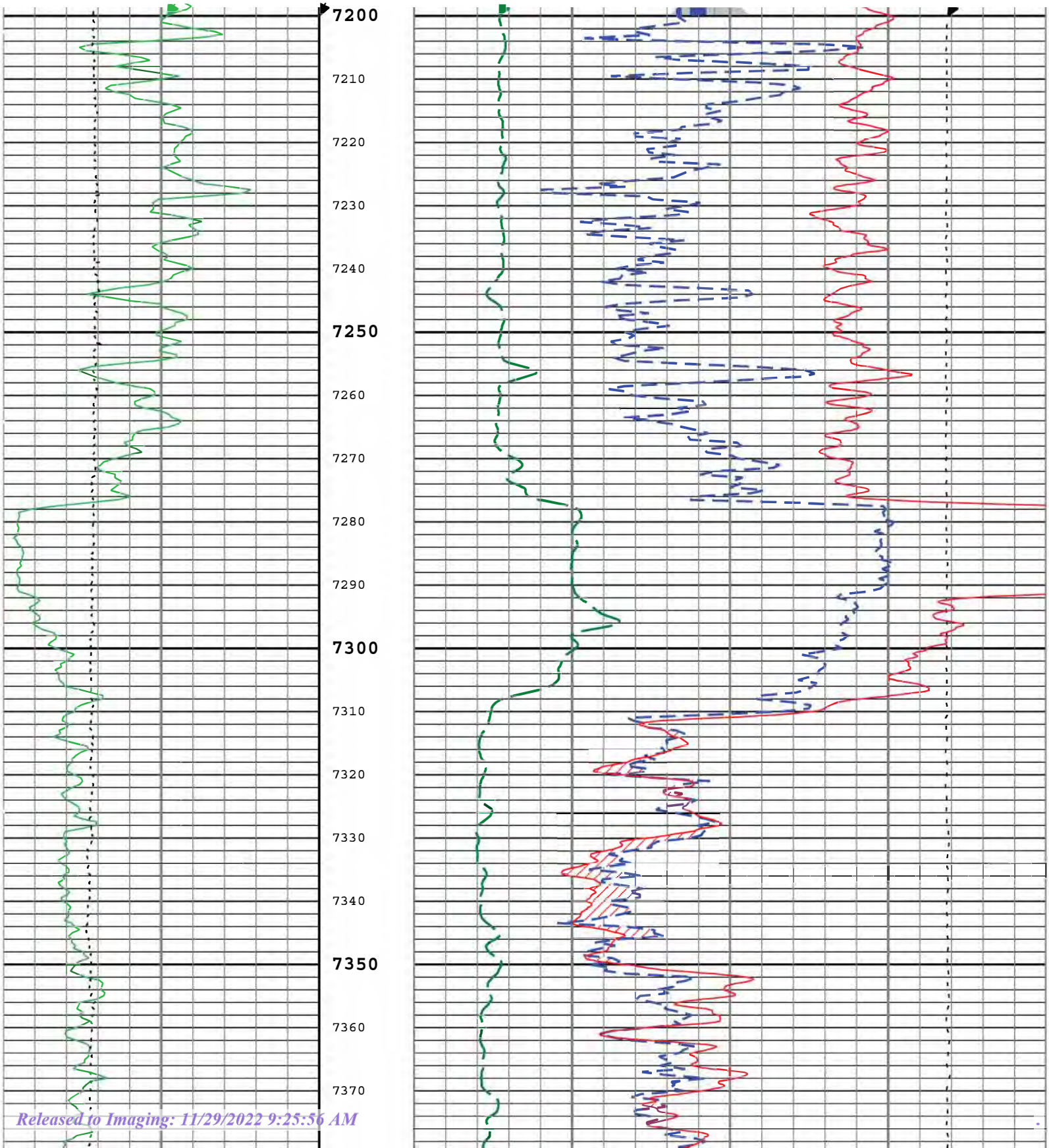
APPENDIX D. COPY OF ELECTRIC LOG

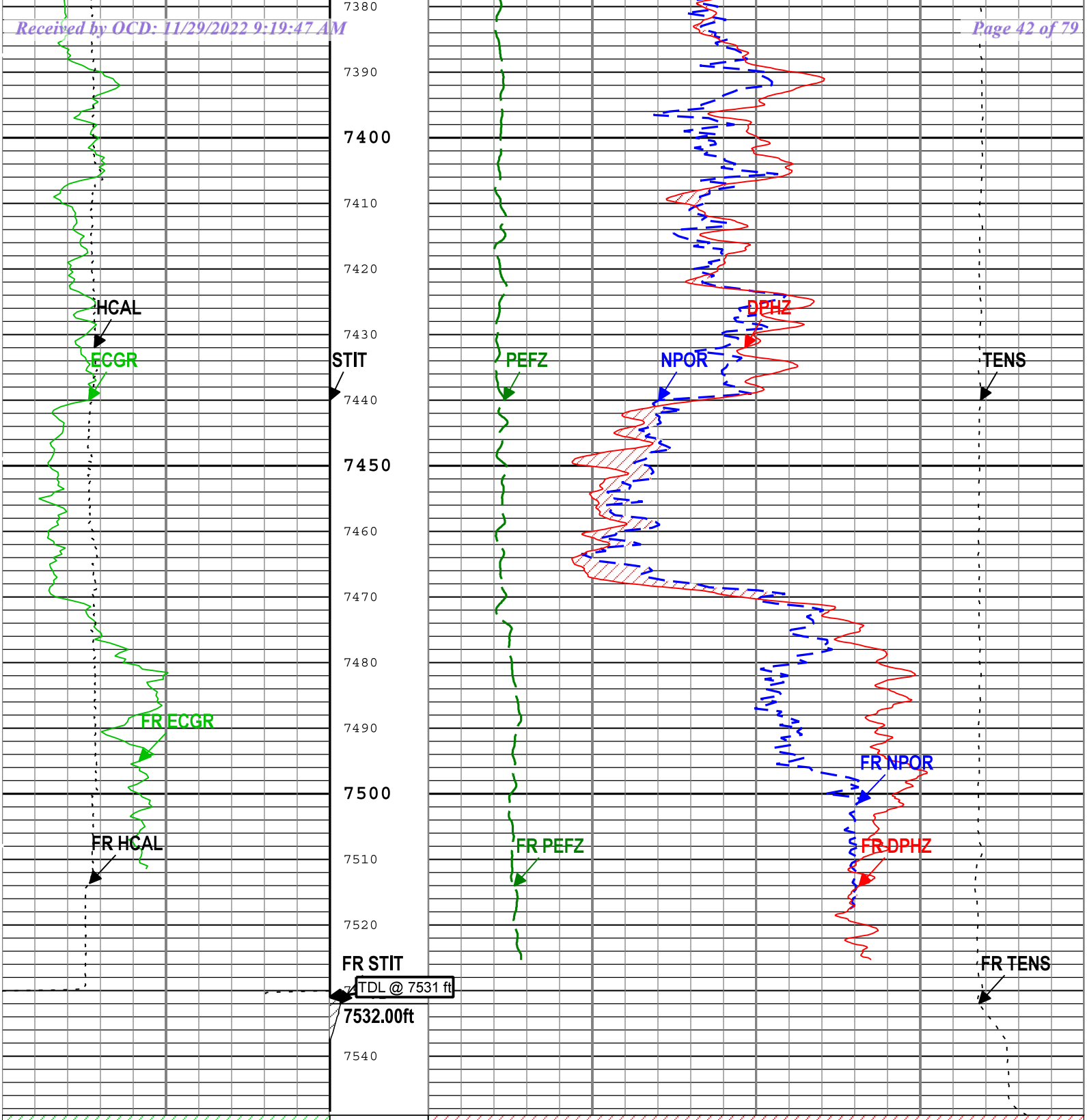
Dual Induction Log Sections from 7200 feet to 7532 feet

Porosity Log Sections from 7200 feet to 7532 feet

Table 1: A copy of the well log showing the Entrada interval to be tested.




7200
7210
7220
7230
7240
7250
7260
7270
7280
7290
7300
7310
7320
7330
7340
7350
7360
7370



Gamma Ray Back up

Gamma Ray (ECGR) HGNS-H

0 gAPI 200

Caliper (HCAL) HDRS-H

6 in 16

Stuck Tool Indicator, Total (STIT)

0 ft 50

ToolDrag

Gas Effect

NPOR Backup

Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H

0.3 m3/m3 -0.1

Standard Resolution Density Porosity (DPHZ) HDRS-H

0.3 ft3/ft3 -0.1

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10

Cable Tension (TENS)

10000 lbf 0

APPENDIX E. AREA OF REVIEW

ONE-MILE AREA OF REVIEW

Strata, LLC

Western Refining Southwest LLC Waste Disposal Well No. 2

Project ID. MPC.FNM.22.01

9/29/2022

Record No.	API	Well Name	Well Type	Well Status	PLSS Location (ULSTR)	Vertical Depth	Penetrates Inj. Zone	Effective Date	Plug Date	Record Last Edited Date
1	30-045-24573	GARLAND #003	Gas	Active	M-27-29N-11W	2,905	N	8/20/2020		8/20/2020, 2:28 PM
2	30-045-21732	GARLAND B #001R	Gas	Plugged (site released)	M-27-29N-11W	1,810	N	6/1/1975	8/9/2010	3/6/2014, 1:28 PM
3	30-045-07903	PRE-ONGARD WELL #001	Gas	Plugged (site released)	M-27-29N-11W	1,747	N	1/1/1900	7/1/1975	3/6/2014, 1:28 PM
4	30-045-07896	PRE-ONGARD WELL #001	Gas	Plugged (site released)	C-27-29N-11W	0	N	1/1/1900	11/27/1978	3/6/2014, 1:28 PM
5	30-045-25707	SUMMIT #015	Gas	Active	C-34-29N-11W	6,216	N	8/20/2020		8/20/2020, 2:28 PM
6	30-045-07835	MANGUM #001	Gas	Active	L-27-29N-11W	6,350	N	1/6/2017		1/6/2017, 1:08 PM
7	30-045-26731	MARY JANE #001	Gas	Active	N-22-29N-11W	2,845	N	4/8/1986		3/6/2014, 1:28 PM
8	30-045-27361	LAUREN KELLY #001	Gas	Active	F-27-29N-11W	1,500	N	3/29/1994		3/6/2014, 1:28 PM
9	30-045-24673	MANGUM #001E	Gas	Active	F-27-29N-11W	6,240	N	8/4/2017		8/4/2017, 2:51 PM
10	30-045-13089	COOK #002	Gas	Active	N-22-29N-11W	1,440	N	1/1/1900		3/6/2014, 1:28 PM
11	30-045-25673	CONGRESS #018	Oil	Active	K-27-29N-11W	6,150	N	8/1/2017		8/1/2017, 12:30 PM
12	30-045-34312	ROYAL FLUSH #001	Gas	Active	N-22-29N-11W	2,045	N	5/11/2007		3/6/2014, 1:28 PM
13	30-045-27365	MARIAN S #001	Gas	Active	F-27-29N-11W	2,840	N	6/13/1989		3/6/2014, 1:28 PM
14	30-045-07940	COOK #001	Gas	Active	N-22-29N-11W	6,305	N	3/28/1994		3/6/2014, 1:28 PM
15	30-045-34266	MANGUM #001S	Gas	Cancelled	F-27-29N-11W	0	N	12/13/2007		3/6/2014, 1:28 PM
16	30-045-07959	GRACE PEARCE #001	Gas	Plugged (site released)	O-22-29N-11W	1,620	N	1/1/1900	3/2/2000	3/6/2014, 1:28 PM
17	30-045-29002	DISPOSAL #001	Salt Water Disposal	Plugged (site released)	I-27-29N-11W	3,601	N	9/24/1993	10/29/2015	3/30/2017, 3:34 PM
18	30-045-23554	DAVIS GAS COM G #001	Gas	Plugged (site released)	I-27-29N-11W	2,951	N	1/1/1998	11/15/2011	3/6/2014, 1:28 PM
19	30-045-24574	SUMMIT #009	Gas	Active	A-34-29N-11W	2,985	N	8/1/2017		2/19/2018, 4:55 PM
20	30-045-07825	DAVIS GAS COM F #001	Gas	Plugged (site released)	I-27-29N-11W	6,365	N	5/25/1994	1/19/1994	3/6/2014, 1:28 PM
21	30-045-24084	DAVIS GAS COM F #001E	Gas	Active	H-27-29N-11W	6,392	N	7/12/2018		7/12/2018, 4:33 PM
22	30-045-07812	PRE-ONGARD WELL #001	Gas	Plugged (site released)	I-27-29N-11W	1,804	N	1/1/1900	11/3/1982	3/6/2014, 1:28 PM
23	30-045-34463	JACQUE #001	Gas	Active	I-27-29N-11W	1,890	N	10/18/2007		3/6/2014, 1:28 PM
24	30-045-25745	PRE-ONGARD WELL #1	Gas	Cancelled	E-26-29N-11W	0	N	6/9/1983		3/6/2014, 1:28 PM
25	30-045-26721	NANCY HARTMAN #002	Gas	Active	P-22-29N-11W	2,824	N	5/1/1987		3/6/2014, 1:28 PM
26	30-045-23553	PRE-ONGARD WELL #001	Gas	Plugged (site released)	H-27-29N-11W	0	N	5/23/1979	12/31/1901	3/6/2014, 1:28 PM
27	30-045-07961	HARTMAN #001	Gas	Plugged (site released)	P-22-29N-11W	6,310	N	1/1/1900	6/14/1999	3/6/2014, 1:28 PM
28	30-045-30833	DAVIS GAS COM F #001R	Gas	Active	I-27-29N-11W	6,700	N	7/12/2018		7/12/2018, 4:33 PM
29	30-045-35747	WASTE DISPOSAL WELL #002	Salt Water Disposal	Active	H-27-29N-11W	7,525	Y	6/16/2016		3/16/2017, 3:13 PM

ONE-MILE AREA OF REVIEW

Strata, LLC

Western Refining Southwest LLC Waste Disposal Well No. 2

Project ID. MPC.FNM.22.01

9/29/2022

Record No.	API	Well Name	Well Type	Well Status	PLSS Location (ULSTR)	Vertical Depth	Penetrates Inj. Zone	Effective Date	Plug Date	Record Last Edited Date
30	30-045-07776	PRE-ONGARD WELL #001	Gas	Plugged (site released)	M-26-29N-11W	0	N	1/1/1900	12/31/1901	3/6/2014, 1:28 PM
31	30-045-07883	PRE-ONGARD WELL #002	Gas	Plugged (site released)	H-27-29N-11W	0	N	2/4/1953	12/31/1901	3/6/2014, 1:28 PM
32	30-045-34409	JACQUE #002	Gas	Active	H-27-29N-11W	1,897	N	8/29/2007		3/6/2014, 1:28 PM
33	30-045-25657	CONGRESS #016	Oil	Active	A-34-29N-11W	6,200	N	8/1/2017		8/1/2017, 12:30 PM
34	30-045-24572	CONGRESS #009	Gas	Active	N-26-29N-11W	2,960	N	8/20/2020		8/20/2020, 2:28 PM
35	30-045-07985	PEARCE GAS COM #001	Gas	Plugged (site released)	K-23-29N-11W	6,274	N	3/24/1994	3/12/1997	3/6/2014, 1:28 PM
36	30-045-12003	CALVIN #001	Gas	Active	M-26-29N-11W	6,450	N	8/29/2017		8/29/2017, 3:53 PM
37	30-045-24083	SULLIVAN GAS COM D #001E	Gas	Active	F-26-29N-11W	6,329	N	7/12/2018		7/12/2018, 4:33 PM
38	30-045-24837	CONGRESS #004E	Gas	Active	E-35-29N-11W	6,508	N	8/1/2017		8/1/2017, 12:30 PM
39	30-045-25329	DAVIS GAS COM J #001	Gas	Active	F-26-29N-11W	4,331	N	7/1/2008		3/6/2014, 1:28 PM
40	30-045-20752	LEA ANN #001	Gas	Plugged (site released)	E-35-29N-11W	1,900	N	1/1/1900	12/18/1999	3/6/2014, 1:28 PM
41	30-045-25675	CONGRESS #015	Oil	Active	C-35-29N-11W	6,030	N	8/1/2017		8/1/2017, 12:30 PM
42	30-045-08009	PRE-ONGARD WELL #001	Gas	Plugged (site released)	K-23-29N-11W	1,507	N	9/30/1960	8/26/1980	3/6/2014, 1:28 PM
43	30-045-23550	STATE GAS COM BS #001	Gas	Active	K-23-29N-11W	2,954	N	10/14/2005		3/6/2014, 1:28 PM
44	30-045-23552	PRE-ONGARD WELL #1	Gas	Cancelled	F-26-29N-11W	0	N	5/23/1979		3/6/2014, 1:28 PM
45	30-045-25612	CALVIN #003	Oil	Active	K-26-29N-11W	5,970	N	8/1/2017		8/1/2017, 12:34 PM
46	30-045-23551	PRE-ONGARD WELL #1	Gas	Cancelled	O-23-29N-11W	0	N	5/23/1979		3/6/2014, 1:28 PM
47	30-045-07733	SULLIVAN GAS COM D #001	Gas	Active	B-26-29N-11W	6,260	N	7/12/2018		7/12/2018, 4:33 PM
48	30-045-30788	ASHCROFT SWD #001	Salt Water Disposal	Active	B-26-29N-11W	7,512	Y	7/12/2018		7/12/2018, 4:33 PM
49	30-045-31118	CALVIN #100	Gas	Active	N-26-29N-11W	1,970	N	8/29/2017		8/29/2017, 3:53 PM
50	30-045-24082	PEARCE GAS COM #001E	Gas	Active	J-23-29N-11W	6,365	N	7/12/2018		5/8/2019, 3:17 PM
51	30-045-24772	CALVIN #001E	Gas	Active	P-26-29N-11W	6,500	N	8/14/2017		2/22/2019, 10:48 AM
52	30-045-25738	PRE-ONGARD WELL #23	Gas	Cancelled	I-26-29N-11W	0	N	6/3/1983		3/6/2014, 1:28 PM
53	30-045-23163	EARL B SULLIVAN #001	Gas	Active	B-26-29N-11W	2,861	N	7/12/2018		7/12/2018, 4:33 PM
54	30-045-29107	PRE-ONGARD WELL #001X	Gas	Plugged (site released)	G-26-29N-11W	0	N	1/1/1900	7/28/1955	3/6/2014, 1:28 PM
55	30-045-07868	SULLIVAN #002	Gas	Active	H-26-29N-11W	1,478	N	9/7/1994		3/6/2014, 1:28 PM
56	30-045-33093	CALVIN #001F	Gas	Active	J-26-29N-11W	6,525	N	8/14/2017		8/14/2017, 12:04 PM
57	30-045-21457	DELO #010	Gas	Active	I-26-29N-11W	2,900	N	8/20/2020		8/20/2020, 2:28 PM
58	30-045-25195	CALVIN #002	Oil	Active	P-26-29N-11W	5,950	N	8/1/2017		8/1/2017, 12:30 PM

ONE-MILE AREA OF REVIEW

Strata, LLC

Western Refining Southwest LLC Waste Disposal Well No. 2

Project ID. MPC.FNM.22.01

9/29/2022

Record No.	API	Well Name	Well Type	Well Status	PLSS Location (ULSTR)	Vertical Depth	Penetrates Inj. Zone	Effective Date	Plug Date	Record Last Edited Date
59	30-045-22639	DELO #011	Gas	Plugged (site released)	P-26-29N-11W	1,945	N	11/1/1981	7/30/2010	3/6/2014, 1:28 PM
60	30-045-25621	EARL B SULLIVAN #002	Oil	Active	H-26-29N-11W	5,751	N	7/1/2008		3/6/2014, 1:28 PM
61	30-045-07870	PRE-ONGARD WELL #00X	Gas	Plugged (site released)	G-26-29N-11W	1,442	N	1/1/1900	7/1/1953	3/6/2014, 1:28 PM

APPENDIX F. INJECTION AND FORMATION FLUID ANALYSIS

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 27, 2022

Gary Russell

Western Refining Southwest, Inc.
#50 CR 4990
Bloomfield, NM 87413
TEL: (505) 632-4135
FAX

RE: Injection Well Quarterly OrderNo.: 2209735

Dear Gary Russell:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/15/2022 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued October 18, 2022.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **2209735**
Date Reported: **10/27/2022**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc. **Client Sample ID:** Injection Well
Project: Injection Well Quarterly **Collection Date:** 9/14/2022 2:00:00 PM
Lab ID: 2209735-001 **Matrix:** AQUEOUS **Received Date:** 9/15/2022 7:35:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8270C TCLP						Analyst: **JME**	
2-Methylphenol	ND	200		mg/L	1	9/22/2022 5:57:20 PM	70230
3+4-Methylphenol	ND	200		mg/L	1	9/22/2022 5:57:20 PM	70230
2,4-Dinitrotoluene	ND	0.13		mg/L	1	9/22/2022 5:57:20 PM	70230
Hexachlorobenzene	ND	0.13		mg/L	1	9/22/2022 5:57:20 PM	70230
Hexachlorobutadiene	ND	0.50		mg/L	1	9/22/2022 5:57:20 PM	70230
Hexachloroethane	ND	3.0		mg/L	1	9/22/2022 5:57:20 PM	70230
Nitrobenzene	ND	2.0		mg/L	1	9/22/2022 5:57:20 PM	70230
Pentachlorophenol	ND	100		mg/L	1	9/22/2022 5:57:20 PM	70230
Pyridine	ND	5.0	E	mg/L	1	9/22/2022 5:57:20 PM	70230
2,4,5-Trichlorophenol	ND	400		mg/L	1	9/22/2022 5:57:20 PM	70230
2,4,6-Trichlorophenol	ND	2.0		mg/L	1	9/22/2022 5:57:20 PM	70230
Cresols, Total	ND	200		mg/L	1	9/22/2022 5:57:20 PM	70230
Surr: 2-Fluorophenol	49.7	18.1-88.9		%Rec	1	9/22/2022 5:57:20 PM	70230
Surr: Phenol-d5	37.3	17-61.5		%Rec	1	9/22/2022 5:57:20 PM	70230
Surr: 2,4,6-Tribromophenol	64.8	29.8-104		%Rec	1	9/22/2022 5:57:20 PM	70230
Surr: Nitrobenzene-d5	60.8	22.2-111		%Rec	1	9/22/2022 5:57:20 PM	70230
Surr: 2-Fluorobiphenyl	58.7	24.6-96.3		%Rec	1	9/22/2022 5:57:20 PM	70230
Surr: 4-Terphenyl-d14	84.8	53.4-124		%Rec	1	9/22/2022 5:57:20 PM	70230

NOTES:
Pyridine recovery in the LCS was below the established limits. The MS/MSD had accceptable recoveries.

SPECIFIC GRAVITY						Analyst: **CAS**	
Specific Gravity	0.9971	0			1	10/3/2022 2:34:00 PM	R91481
EPA METHOD 300.0: ANIONS						Analyst: **JTT**	
Fluoride	0.55	0.50		mg/L	5	9/15/2022 6:01:27 PM	R91085
Chloride	910	50	*	mg/L	100	9/19/2022 10:41:45 AM	R91145
Nitrogen, Nitrite (As N)	ND	0.50		mg/L	5	9/15/2022 6:01:27 PM	R91085
Bromide	2.6	0.50		mg/L	5	9/15/2022 6:01:27 PM	R91085
Nitrogen, Nitrate (As N)	ND	0.50		mg/L	5	9/15/2022 6:01:27 PM	R91085
Phosphorus, Orthophosphate (As P)	ND	2.5		mg/L	5	9/15/2022 6:01:27 PM	R91085
Sulfate	79	2.5		mg/L	5	9/15/2022 6:01:27 PM	R91085
SM2510B: SPECIFIC CONDUCTANCE						Analyst: **JTT**	
Conductivity	4100	10		µmhos/c	1	9/19/2022 2:14:14 PM	R91160
SM2320B: ALKALINITY						Analyst: **JTT**	
Bicarbonate (As CaCO3)	540.8	20.00		mg/L Ca	1	9/19/2022 2:14:14 PM	R91160
Carbonate (As CaCO3)	ND	2.000		mg/L Ca	1	9/19/2022 2:14:14 PM	R91160
Total Alkalinity (as CaCO3)	540.8	20.00		mg/L Ca	1	9/19/2022 2:14:14 PM	R91160
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **SNS**	

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

Analytical Report
Lab Order **2209735**
Date Reported: **10/27/2022**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc. **Client Sample ID:** Injection Well
Project: Injection Well Quarterly **Collection Date:** 9/14/2022 2:00:00 PM
Lab ID: 2209735-001 **Matrix:** AQUEOUS **Received Date:** 9/15/2022 7:35:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst:	**SNS**
Total Dissolved Solids	2330	40.0	*D	mg/L	1	9/20/2022 10:02:00 AM	70220
SM4500-H+B / 9040C: PH						Analyst:	**JTT**
pH	8.25		H	pH units	1	9/19/2022 2:14:14 PM	R91160
EPA METHOD 200.7: DISSOLVED METALS						Analyst:	**JRR**
Calcium	49	5.0		mg/L	5	9/27/2022 3:53:32 PM	C91347
Magnesium	36	5.0		mg/L	5	9/27/2022 3:53:32 PM	C91347
Potassium	22	5.0		mg/L	5	9/27/2022 3:53:32 PM	C91347
Sodium	780	10		mg/L	10	10/3/2022 11:53:11 AM	A91479
EPA METHOD 7470A: MERCURY						Analyst:	**VP**
Mercury	ND	0.00020		mg/L	1	10/10/2022 3:33:36 PM	70693
EPA 6010B: TOTAL RECOVERABLE METALS						Analyst:	**JRR**
Arsenic	ND	0.030		mg/L	1	9/21/2022 3:46:22 PM	70262
Barium	0.16	0.0020		mg/L	1	9/21/2022 3:46:22 PM	70262
Cadmium	ND	0.0020		mg/L	1	9/21/2022 3:46:22 PM	70262
Chromium	ND	0.0060		mg/L	1	9/21/2022 3:46:22 PM	70262
Lead	ND	0.020		mg/L	1	9/21/2022 3:46:22 PM	70262
Selenium	ND	0.050		mg/L	1	9/21/2022 3:46:22 PM	70262
Silver	ND	0.0050		mg/L	1	9/21/2022 3:46:22 PM	70262
EPA METHOD 8081: PESTICIDES						Analyst:	**JME**
Chlordane	ND	1.0		µg/L	1	9/23/2022 11:21:47 AM	70310
Surr: Decachlorobiphenyl	89.7	40.9-111		%Rec	1	9/23/2022 11:21:47 AM	70310
Surr: Tetrachloro-m-xylene	63.4	15-107		%Rec	1	9/23/2022 11:21:47 AM	70310
TCLP VOLATILES BY 8260B						Analyst:	**CCM**
Benzene	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
Toluene	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
Ethylbenzene	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
Xylenes, Total	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
1,2-Dichloroethane (EDC)	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
2-Butanone	ND	200		mg/L	200	9/15/2022 10:48:00 PM	T91060
Carbon Tetrachloride	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
Chloroform	ND	6.0		mg/L	200	9/15/2022 10:48:00 PM	T91060
1,4-Dichlorobenzene	ND	7.5		mg/L	200	9/15/2022 10:48:00 PM	T91060
1,1-Dichloroethene	ND	0.70		mg/L	200	9/15/2022 10:48:00 PM	T91060
Tetrachloroethene (PCE)	ND	0.70		mg/L	200	9/15/2022 10:48:00 PM	T91060
Trichloroethene (TCE)	ND	0.50		mg/L	200	9/15/2022 10:48:00 PM	T91060
Vinyl chloride	ND	0.20		mg/L	200	9/15/2022 10:48:00 PM	T91060

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

Analytical Report
Lab Order **2209735**
Date Reported: **10/27/2022**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc. **Client Sample ID:** Injection Well
Project: Injection Well Quarterly **Collection Date:** 9/14/2022 2:00:00 PM
Lab ID: 2209735-001 **Matrix:** AQUEOUS **Received Date:** 9/15/2022 7:35:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
TCLP VOLATILES BY 8260B						Analyst: **CCM**	
Chlorobenzene	ND	100		mg/L	200	9/15/2022 10:48:00 PM	T91060
Surr: 1,2-Dichloroethane-d4	108	70-130		%Rec	200	9/15/2022 10:48:00 PM	T91060
Surr: 4-Bromofluorobenzene	90.2	70-130		%Rec	200	9/15/2022 10:48:00 PM	T91060
Surr: Dibromofluoromethane	107	70-130		%Rec	200	9/15/2022 10:48:00 PM	T91060
Surr: Toluene-d8	88.2	70-130		%Rec	200	9/15/2022 10:48:00 PM	T91060

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Client:	Hall Environmental Analysis Lab	Work Order:	MCI0695
Address:	4901 Hawkins NE Suite D	Project:	2209735
	Albuquerque, NM 87109	Reported:	10/26/2022 15:55
Attn:	Andy Freeman		

Analytical Results Report

Sample Location:	2209735-001F (Injection Well)		
Lab/Sample Number:	MCI0695-01	Collect Date:	09/14/22 14:00
Date Received:	09/14/22 12:47	Collected By:	
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
pH	8.24 @ 20.6°C	pH Units		9/22/22 14:02	CC	SM 4500-H-B	H5
Reactive sulfide	ND	mg/L	0.316	10/17/22 10:14	GPB	SW 846 Ch 7	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	2209735-001F (Injection Well)		
Lab/Sample Number:	MCI0695-02	Collect Date:	09/14/22 14:00
Date Received:	09/14/22 12:47	Collected By:	EJ Anderson
Matrix:	WATER		

Analyte	Result	Units	PQL	MCL	Analyzed	Analyst	Method	Qualifier
Inorganics								
Oxidation-Reduction Potential	182	millivolts			9/23/22 16:00	ARC	SM 2580 B	H1

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report

(Continued)

Sample Location:	2209735-001F (Injection Well)		
Lab/Sample Number:	MCI0695-03	Collect Date:	09/14/22 14:00
Date Received:	09/14/22 12:47	Collected By:	EJ Anderson
Matrix:	WATER		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Flashpoint	>200°F	°F		10/26/22 15:55	TAZ	EPA 1010	

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

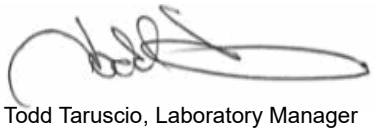
Analytical Results Report

(Continued)

Sample Location:	2209735-001F (Injection Well)		
Lab/Sample Number:	MCI0695-04	Collect Date:	09/14/22 14:00
Date Received:	09/14/22 12:47	Collected By:	EJ Anderson
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Cyanide (reactive)	ND	mg/L	0.0100	9/28/22 15:30	MMC	SW 846 Ch 7	

Authorized Signature,



Todd Taruscio, Laboratory Manager

H1	Sample analysis performed past holding time.
H5	This test is specified to be performed in the field within 15 minutes of sampling; sample was received and analyzed past the regulatory holding time.
PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Quality Control Data

Inorganics

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BCI0806 - Inorganics										
Blank (BCI0806-BLK1)					Prepared: 9/23/2022 Analyzed: 10/17/2022					
Reactive sulfide	ND		0.100	mg/L						
LCS (BCI0806-BS1)					Prepared: 9/23/2022 Analyzed: 10/17/2022					
Reactive sulfide	0.220		0.100	mg/L	0.200		110	70-130		
Matrix Spike (BCI0806-MS1)		**Source: MCI0695-01**			Prepared: 9/23/2022 Analyzed: 10/17/2022					
Reactive sulfide	0.758		0.316	mg/L	0.632	0.0632	110	60-130		
Batch: BCI0818 - W Wet Chem										
Duplicate (BCI0818-DUP1)		**Source: MCI0695-02**			Prepared & Analyzed: 9/23/2022					
Oxidation-Reduction Potential	180			millivolts		182			0.885	20
Batch: BCI0991 - Cyanide										
Blank (BCI0991-BLK1)					Prepared & Analyzed: 9/28/2022					
Cyanide (reactive)	ND		0.0100	mg/L						
LCS (BCI0991-BS1)					Prepared & Analyzed: 9/28/2022					
Cyanide (reactive)	0.511		0.0100	mg/L	0.500		102	85-115		
Matrix Spike (BCI0991-MS1)		**Source: MCI0695-04**			Prepared & Analyzed: 9/28/2022					
Cyanide (reactive)	0.421		0.0100	mg/L	0.500	ND	84.3	75-125		
Matrix Spike Dup (BCI0991-MSD1)		**Source: MCI0695-04**			Prepared & Analyzed: 9/28/2022					
Cyanide (reactive)	0.489		0.0100	mg/L	0.500	ND	97.8	75-125	14.9	25

HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

Hall Environmental Analysis Laboratory
4901 Hawkins NE

MC10695

Due: 10/03/22

SUB CONTRATOR: Anatek ID	COMPANY: Anatek Labs, Inc.	PHONE: (208) 883-2839	FAX:
ADDRESS: 1282 Alturas Dr		ACCOUNT #:	EMAIL:
CITY, STATE, ZIP: Moscow, ID 83843			

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2209735-001F	Injection Well	500HDPE	Aqueous	9/14/2022 2:00:00 PM	3	RCI, ORP

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By: CMC	Date: 9/15/2022	Time: 8:31 AM	Received By: JS	Date: 9-16-22	Time: 1414
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☑ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED:

☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples _____ °C Attempt to Cool ? _____

Comments: _____

MCI0695

Due 10/03/22

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: Hall Env

TAT: (Normal) RUSH: _____ days

Samples Received From: (FedEx) UPS USPS Client Courier Other: _____

Custody Seal on Cooler/Box: (Yes) No Custody Seals Intact: (Yes) No N/A

Number of Coolers/Boxes: 3 Type of Ice: Wet Ice (Ice Packs) Dry Ice None

Packing Material: (Bubble Wrap) (Bags) Foam/Peanuts (Paper) None Other: _____

Cooler Temp As Read (°C): 5.1 Cooler Temp Corrected (°C): _____ Thermometer Used: IR-5

				Comments:
Samples Received Intact?	(Yes)	No	N/A	2209735-001F analyst is verifying out of hold time
Chain of Custody Present?	(Yes)	No	N/A	
Samples Received Within Hold Time?	Yes	No	N/A	
Samples Properly Preserved?	Yes	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	(N/A)	
VOC Trip Blanks Present?	Yes	No	(N/A)	
Labels and Chains Agree?	(Yes)	No	N/A	
Total Number of Sample Bottles Received: 3				
Chain of Custody Fully Completed?	(Yes)	No	N/A	
Correct Containers Received?	Yes	No	N/A	
Anatek Bottles Used?	Yes	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

NaOH - CN - P500ml

~~Zinc Acetate/Sodium hydroxide - ORP~~ EE ER 9116/22

Zinc Acetate/Sodium hydroxide - RCI - P500ml

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

ORP/RCI - P500ml

Received/Inspected By: JS Date/Time: 9-16-22 1416

Form F19.00 - Eff 8 Feb 2019

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-C**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW**	Batch ID: **C91347**	RunNo: **91347**
Prep Date:	Analysis Date: **9/27/2022**	SeqNo: **3269825** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								

Sample ID: **LLLCS-C**	SampType: **LCSLL**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC**	Batch ID: **C91347**	RunNo: **91347**
Prep Date:	Analysis Date: **9/27/2022**	SeqNo: **3269826** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0	0.5000	0	108	50	150			
Magnesium	ND	1.0	0.5000	0	110	50	150			
Potassium	ND	1.0	0.5000	0	104	50	150			

Sample ID: **LCS-C**	SampType: **LCS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **C91347**	RunNo: **91347**
Prep Date:	Analysis Date: **9/27/2022**	SeqNo: **3269827** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	51	1.0	50.00	0	103	85	115			
Magnesium	51	1.0	50.00	0	103	85	115			
Potassium	50	1.0	50.00	0	101	85	115			

Sample ID: **2209735-001DMS**	SampType: **MS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **Injection Well**	Batch ID: **C91347**	RunNo: **91347**
Prep Date:	Analysis Date: **9/27/2022**	SeqNo: **3269952** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	310	5.0	250.0	49.25	103	70	130			
Magnesium	290	5.0	250.0	35.81	102	70	130			
Potassium	270	5.0	250.0	21.84	100	70	130			

Sample ID: **2209735-001DMSD**	SampType: **MSD**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **Injection Well**	Batch ID: **C91347**	RunNo: **91347**
Prep Date:	Analysis Date: **9/27/2022**	SeqNo: **3269953** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	310	5.0	250.0	49.25	104	70	130	0.823	20	
Magnesium	290	5.0	250.0	35.81	103	70	130	1.12	20	
Potassium	280	5.0	250.0	21.84	101	70	130	1.02	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-A**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW**	Batch ID: **A91479**	RunNo: **91479**
Prep Date:	Analysis Date: **10/3/2022**	SeqNo: **3276375** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0								

Sample ID: **LLLCS-A**	SampType: **LCSLL**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC**	Batch ID: **A91479**	RunNo: **91479**
Prep Date:	Analysis Date: **10/3/2022**	SeqNo: **3276376** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0	0.5000	0	134	50	150			

Sample ID: **LCS-A**	SampType: **LCS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **A91479**	RunNo: **91479**
Prep Date:	Analysis Date: **10/3/2022**	SeqNo: **3276377** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	53	1.0	50.00	0	106	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R91085**	RunNo: **91085**
Prep Date:	Analysis Date: **9/15/2022**	SeqNo: **3258177** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Nitrogen, Nitrite (As N)	ND	0.10								
Bromide	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Phosphorus, Orthophosphate (As P	ND	0.50								
Sulfate	ND	0.50								

Sample ID: **LCS**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R91085**	RunNo: **91085**
Prep Date:	Analysis Date: **9/15/2022**	SeqNo: **3258178** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.54	0.10	0.5000	0	107	90	110			
Nitrogen, Nitrite (As N)	0.99	0.10	1.000	0	98.6	90	110			
Bromide	2.5	0.10	2.500	0	98.7	90	110			
Nitrogen, Nitrate (As N)	2.6	0.10	2.500	0	102	90	110			
Phosphorus, Orthophosphate (As P	4.5	0.50	5.000	0	90.5	90	110			
Sulfate	9.9	0.50	10.00	0	98.6	90	110			

Sample ID: **MB**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R91145**	RunNo: **91145**
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3260946** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								

Sample ID: **LCS**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R91145**	RunNo: **91145**
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3260947** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.8	0.50	5.000	0	95.0	90	110			

Sample ID: **MB**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R91145**	RunNo: **91145**
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3260983** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **LCS**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**							
Client ID: **LCSW**	Batch ID: **R91145**	RunNo: **91145**							
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3260984**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.8	0.50	5.000	0	96.7	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-70310** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266323** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chlordane	ND	1.0								
Surr: Decachlorobiphenyl	2.3		2.500		91.2	40.9	111			
Surr: Tetrachloro-m-xylene	1.8		2.500		73.8	15	107			

Sample ID: **MB-70310** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266326** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chlordane	ND	1.0								
Surr: Decachlorobiphenyl	2.3		2.500		91.9	40.9	111			
Surr: Tetrachloro-m-xylene	1.8		2.500		73.9	15	107			

Sample ID: **LCS-70310** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266329** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.2		2.500		86.4	40.9	111			
Surr: Tetrachloro-m-xylene	1.7		2.500		68.6	15	107			

Sample ID: **LCS-70310** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266330** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.2		2.500		87.0	40.9	111			
Surr: Tetrachloro-m-xylene	1.7		2.500		67.9	15	107			

Sample ID: **LCSD-70310** SampType: **LCSD** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS02** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266331** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.0		2.500		81.5	40.9	111	0	20	
Surr: Tetrachloro-m-xylene	1.5		2.500		59.7	15	107	0	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **LCSD-70310** SampType: **LCSD** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS02** Batch ID: **70310** RunNo: **91275**
Prep Date: **9/21/2022** Analysis Date: **9/23/2022** SeqNo: **3266332** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	1.9		2.500		77.3	40.9	111	0	20	
Surr: Tetrachloro-m-xylene	1.7		2.500		66.3	15	107	0	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **mb**	SampType: **MBLK**	TestCode: **TCLP Volatiles by 8260B**
Client ID: **PBW**	Batch ID: **T91060**	RunNo: **91060**
Prep Date:	Analysis Date: **9/15/2022**	SeqNo: **3258171** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.50								
1,2-Dichloroethane (EDC)	ND	0.50								
2-Butanone	ND	200								
Carbon Tetrachloride	ND	0.50								
Chloroform	ND	6.0								
1,4-Dichlorobenzene	ND	7.5								
1,1-Dichloroethene	ND	0.70								
Tetrachloroethene (PCE)	ND	0.70								
Trichloroethene (TCE)	ND	0.50								
Vinyl chloride	ND	0.20								
Chlorobenzene	ND	100								
Surr: 1,2-Dichloroethane-d4	0.010		0.01000		104	70	130			
Surr: 4-Bromofluorobenzene	0.0088		0.01000		87.8	70	130			
Surr: Dibromofluoromethane	0.010		0.01000		104	70	130			
Surr: Toluene-d8	0.0090		0.01000		90.3	70	130			

Sample ID: **100ng lcs**	SampType: **LCS**	TestCode: **TCLP Volatiles by 8260B**
Client ID: **LCSW**	Batch ID: **T91060**	RunNo: **91060**
Prep Date:	Analysis Date: **9/15/2022**	SeqNo: **3258172** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.020	0.00023	0.02000	0	102	70	130			
1,1-Dichloroethene	0.019	0.00020	0.02000	0	94.7	70	130			
Trichloroethene (TCE)	0.019	0.00020	0.02000	0	97.4	70	130			
Chlorobenzene	0.020	0.00016	0.02000	0	98.3	70	130			
Surr: 1,2-Dichloroethane-d4	0.010		0.01000		104	70	130			
Surr: 4-Bromofluorobenzene	0.0092		0.01000		92.4	70	130			
Surr: Dibromofluoromethane	0.010		0.01000		100	70	130			
Surr: Toluene-d8	0.0090		0.01000		89.8	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-70230**	SampType: **MBLK**	TestCode: **EPA Method 8270C TCLP**
Client ID: **PBW**	Batch ID: **70230**	RunNo: **91245**
Prep Date: **9/16/2022**	Analysis Date: **9/22/2022**	SeqNo: **3265631** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	ND	200								
3+4-Methylphenol	ND	200								
2,4-Dinitrotoluene	ND	0.13								
Hexachlorobenzene	ND	0.13								
Hexachlorobutadiene	ND	0.50								
Hexachloroethane	ND	3.0								
Nitrobenzene	ND	2.0								
Pentachlorophenol	ND	100								
Pyridine	ND	5.0								E
2,4,5-Trichlorophenol	ND	400								
2,4,6-Trichlorophenol	ND	2.0								
Cresols, Total	ND	200								
Surr: 2-Fluorophenol	0.066		0.2000		32.8	18.1	88.9			
Surr: Phenol-d5	0.050		0.2000		25.2	17	61.5			
Surr: 2,4,6-Tribromophenol	0.087		0.2000		43.5	29.8	104			
Surr: Nitrobenzene-d5	0.043		0.1000		42.7	22.2	111			
Surr: 2-Fluorobiphenyl	0.042		0.1000		41.7	24.6	96.3			
Surr: 4-Terphenyl-d14	0.073		0.1000		73.0	53.4	124			

Sample ID: **LCS-70230**	SampType: **LCS**	TestCode: **EPA Method 8270C TCLP**
Client ID: **LCSW**	Batch ID: **70230**	RunNo: **91245**
Prep Date: **9/16/2022**	Analysis Date: **9/22/2022**	SeqNo: **3265632** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.064	0.00010	0.1000	0	63.6	19	106			
3+4-Methylphenol	0.13	0.00010	0.2000	0	67.0	16.3	112			
2,4-Dinitrotoluene	0.050	0.00010	0.1000	0	50.4	15	99.6			
Hexachlorobenzene	0.056	0.00010	0.1000	0	56.1	41.8	111			
Hexachlorobutadiene	0.042	0.00010	0.1000	0	41.7	15	91.5			
Hexachloroethane	0.050	0.00010	0.1000	0	50.0	15	87.5			
Nitrobenzene	0.059	0.00010	0.1000	0	58.7	19.3	114			
Pentachlorophenol	0.050	0.00010	0.1000	0	50.3	29	103			
Pyridine	0.014	0.00010	0.1000	0	14.3	15	92.6			SE
2,4,5-Trichlorophenol	0.063	0.00010	0.1000	0	63.3	25.2	114			
2,4,6-Trichlorophenol	0.060	0.00010	0.1000	0	60.2	25.7	112			
Cresols, Total	0.20	0.00010	0.3000	0	65.8	15	145			
Surr: 2-Fluorophenol	0.096		0.2000		48.1	18.1	88.9			
Surr: Phenol-d5	0.072		0.2000		36.2	17	61.5			
Surr: 2,4,6-Tribromophenol	0.11		0.2000		54.0	29.8	104			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **LCS-70230** SampType: **LCS** TestCode: **EPA Method 8270C TCLP**
Client ID: **LCSW** Batch ID: **70230** RunNo: **91245**
Prep Date: **9/16/2022** Analysis Date: **9/22/2022** SeqNo: **3265632** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Nitrobenzene-d5	0.062		0.1000		62.2	22.2	111			
Surr: 2-Fluorobiphenyl	0.057		0.1000		56.6	24.6	96.3			
Surr: 4-Terphenyl-d14	0.071		0.1000		71.5	53.4	124			

NOTES:
Pyridine recovery in the LCS was below the established limits.
Pyridine recovery in the LCS was below the established limits.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **lcs-1 98.9uS eC**	SampType: **LCS**		TestCode: **SM2510B: Specific Conductance**		
Client ID: **LCSW**	Batch ID: **R91160**		RunNo: **91160**		
Prep Date:	Analysis Date: **9/19/2022**		SeqNo: **3261531**	Units: **µmhos/cm**	

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	99	10	98.90	0	99.8	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**

27-Oct-22

Client: Western Refining Southwest, Inc.

Project: Injection Well Quarterly

Sample ID: **MB-70693**	SampType: **MBLK**	TestCode: **EPA Method 7470A: Mercury**
Client ID: **PBW**	Batch ID: **70693**	RunNo: **91673**
Prep Date: **10/10/2022**	Analysis Date: **10/10/2022**	SeqNo: **3284866** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID: **LCSLL-70693**	SampType: **LCSLL**	TestCode: **EPA Method 7470A: Mercury**
Client ID: **BatchQC**	Batch ID: **70693**	RunNo: **91673**
Prep Date: **10/10/2022**	Analysis Date: **10/10/2022**	SeqNo: **3284867** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.00020	0.00020	0.0001500	0	135	50	150			

Sample ID: **LCS-70693**	SampType: **LCS**	TestCode: **EPA Method 7470A: Mercury**
Client ID: **LCSW**	Batch ID: **70693**	RunNo: **91673**
Prep Date: **10/10/2022**	Analysis Date: **10/10/2022**	SeqNo: **3284868** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0051	0.00020	0.005000	0	102	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-70262** SampType: **MBLK** TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **PBW** Batch ID: **70262** RunNo: **91211**
Prep Date: **9/19/2022** Analysis Date: **9/21/2022** SeqNo: **3263221** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.030								
Barium	ND	0.0020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Lead	ND	0.020								
Selenium	ND	0.050								
Silver	ND	0.0050								

Sample ID: **LCS-70262** SampType: **LCS** TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **LCSW** Batch ID: **70262** RunNo: **91211**
Prep Date: **9/19/2022** Analysis Date: **9/21/2022** SeqNo: **3263223** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.48	0.030	0.5000	0	95.1	80	120			
Barium	0.46	0.0020	0.5000	0	91.5	80	120			
Cadmium	0.46	0.0020	0.5000	0	92.7	80	120			
Chromium	0.46	0.0060	0.5000	0	91.2	80	120			
Lead	0.47	0.020	0.5000	0	94.4	80	120			
Selenium	0.47	0.050	0.5000	0	93.8	80	120			
Silver	0.093	0.0050	0.1000	0	92.8	80	120			

Sample ID: **2209735-001EMS** SampType: **MS** TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **Injection Well** Batch ID: **70262** RunNo: **91211**
Prep Date: **9/19/2022** Analysis Date: **9/21/2022** SeqNo: **3263230** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.44	0.030	0.5000	0	88.7	75	125			
Barium	0.57	0.0020	0.5000	0.1610	82.4	75	125			
Cadmium	0.44	0.0020	0.5000	0	87.9	75	125			
Chromium	0.42	0.0060	0.5000	0	84.9	75	125			
Lead	0.44	0.020	0.5000	0	88.0	75	125			
Selenium	0.42	0.050	0.5000	0	84.7	75	125			
Silver	0.093	0.0050	0.1000	0	92.7	75	125			

Sample ID: **2209735-001EMSD** SampType: **MSD** TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **Injection Well** Batch ID: **70262** RunNo: **91211**
Prep Date: **9/19/2022** Analysis Date: **9/21/2022** SeqNo: **3263234** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.41	0.030	0.5000	0	81.5	75	125	8.40	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **2209735-001EMSD** SampType: **MSD** TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **Injection Well** Batch ID: **70262** RunNo: **91211**
Prep Date: **9/19/2022** Analysis Date: **9/21/2022** SeqNo: **3263234** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Barium	0.56	0.0020	0.5000	0.1610	79.7	75	125	2.41	20	
Cadmium	0.43	0.0020	0.5000	0	86.5	75	125	1.57	20	
Chromium	0.41	0.0060	0.5000	0	82.7	75	125	2.56	20	
Lead	0.43	0.020	0.5000	0	86.3	75	125	1.95	20	
Selenium	0.44	0.050	0.5000	0	87.2	75	125	2.92	20	
Silver	0.091	0.0050	0.1000	0	91.1	75	125	1.81	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **mb-1 alk**	SampType: **MBLK**	TestCode: **SM2320B: Alkalinity**							
Client ID: **PBW**	Batch ID: **R91160**	RunNo: **91160**							
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3261497**	Units: **mg/L CaCO3**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: **lcs-1 alk**	SampType: **LCS**	TestCode: **SM2320B: Alkalinity**							
Client ID: **LCSW**	Batch ID: **R91160**	RunNo: **91160**							
Prep Date:	Analysis Date: **9/19/2022**	SeqNo: **3261498**	Units: **mg/L CaCO3**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.00	20.00	80.00	0	97.5	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Above Quantitation Range/Estimated Value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2209735**
27-Oct-22

Client: Western Refining Southwest, Inc.
Project: Injection Well Quarterly

Sample ID: **MB-70220**	SampType: **MBLK**	TestCode: **SM2540C MOD: Total Dissolved Solids**							
Client ID: **PBW**	Batch ID: **70220**	RunNo: **91147**							
Prep Date: **9/16/2022**	Analysis Date: **9/20/2022**	SeqNo: **3261025**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: **LCS-70220**	SampType: **LCS**	TestCode: **SM2540C MOD: Total Dissolved Solids**							
Client ID: **LCSW**	Batch ID: **70220**	RunNo: **91147**							
Prep Date: **9/16/2022**	Analysis Date: **9/20/2022**	SeqNo: **3261026**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1020	20.0	1000	0	102	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quanitative Limit
S	% Recovery outside of standard limits. If undiluted results may be estimated.
B	Analyte detected in the associated Method Blank
E	Above Quantitation Range/Estimated Value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: **Western Refining Southwest, Inc.** Work Order Number: **2209735** RcptNo: **1**

Received By: **Juan Rojas** **9/15/2022 7:35:00 AM**

Completed By: **Cheyenne Cason** **9/15/2022 8:24:35 AM**

Reviewed By: JN 9/15/22

Chain of Custody

1. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2. How was the sample delivered?	Courier		

Log In

3. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
5. Sample(s) in proper container(s)?	Yes ☑	No ☐	
6. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
7. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
8. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA?	Yes ☑	No ☐	NA ☐
10. Were any sample containers received broken?	Yes ☐	No ☑	
11. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: 2 3 (<2 or >12 unless noted)
12. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted? ND
13. Is it clear what analyses were requested?	Yes ☑	No ☐	
14. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by: SR 9/15/22

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

16. Additional remarks: Filtered ~100mL and added ~0.4mL HNO3 to 0010 for dissolved metals analysis. Checked for proper pH <2 SR 9/15/22

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.4	Good	Yes			

LOT # FD5640

Chain-of-Custody Record

Client: **Western Refining**

Mailing Address: **50 CR 4990**

Bloomfield, NM 87413

Phone #: **678-594-6377**

email or Fax: gfrussell@marathonpetroleum.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ **Rush**

Project Name: Injection Well [redacted] Quarterly

Project #:

PO # 4500305669

Project Manager: Gary Russell

Sampler:

On Ice: ☒ Yes ☐ No

# of Coolers: 1

Cooler Temp(including CF): 3.4-0=3.4

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2209735	pH, Specific gravity	C/A Balance Dissolved	RCI and ORP	RCRA 8 Metals	Chlordane only by 8081	8260 TCLP list + TEX	8270 TCLP List
9-14-22	14:00	H_2O	**Injection Well** [redacted]	500ml P	none	001	x						
				1 - 125ml P 1 - 500ml P	none			x						
				3-500ml P	1- unpres, 1-NaOH, 1-NaOH/ZnAc				x				
				250ml P	HNO3					x			
				1L Amber G	none						x		
				3-40ml VOAs	HCL							x	
				1L Anmer	none								x

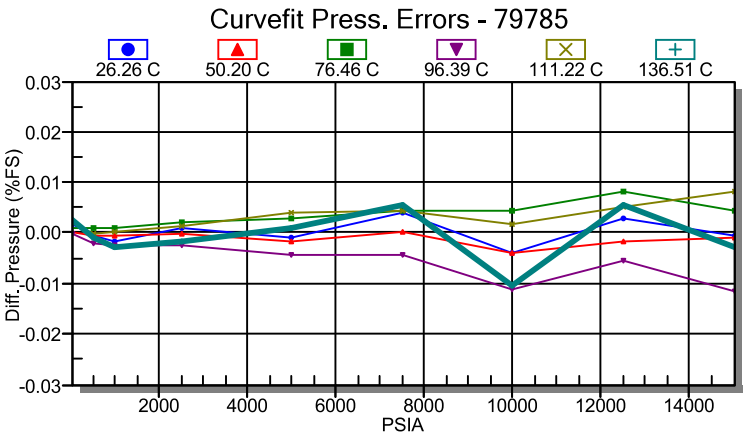
Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
9.14.22	16:20	[signature]	[signature]		9/14/22	1620
9/14/22	1816	[signature]	[signature]	courier	9/15/22	7:35

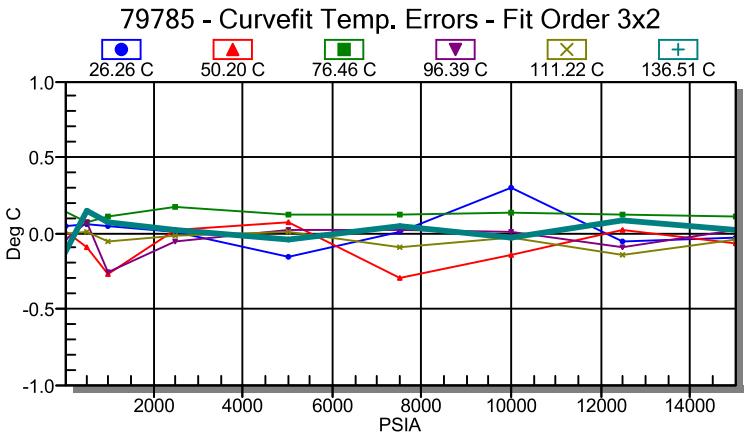
Remarks:

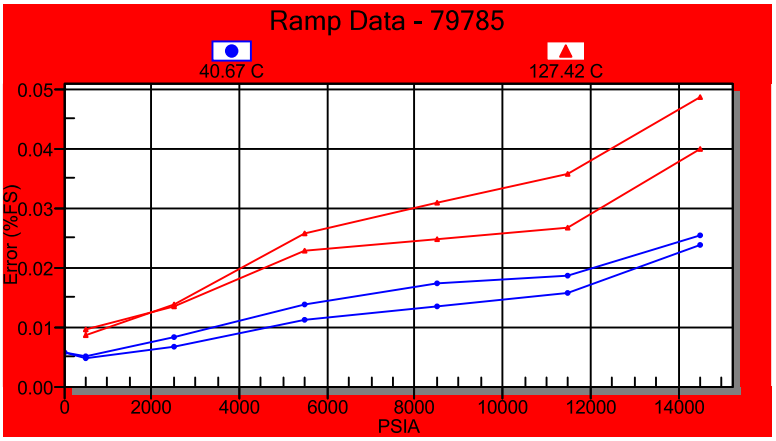
If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

APPENDIX G. TOOL CALIBRATION

79785 Cal Info







Ramp report: Serial # 79785, 2/27/2022
Gauge range = 15000.000 PSI. Max. DIFF. = 4.500
Ramp check result: FAIL, Max Err = 0.049% F.S.

DW Pressure	Gauge Pressure	Differential	%F.S.	RPM4 Press.	Oven Temp.	Gauge Temp.
14500.00	14503.59	3.59	0.0239	14499.20	40.67	40.47
11500.00	11502.34	2.34	0.0156	11499.20	40.58	40.49
8500.00	8502.02	2.02	0.0134	8499.00	40.36	40.49
5500.00	5501.66	1.66	0.0111	5498.80	40.43	40.51
2500.00	2501.00	1.00	0.0066	2498.60	40.45	40.49
499.90	500.58	0.68	0.0046	497.90	40.39	40.42
16.00	16.85	0.85	0.0056	13.80	40.49	40.46
500.00	500.75	0.75	0.0050	497.90	40.41	40.49
2500.00	2501.22	1.22	0.0082	2498.30	40.46	40.53
5500.00	5502.06	2.06	0.0138	5498.70	40.50	40.58
8500.00	8502.59	2.59	0.0173	8498.90	40.42	40.59
11500.00	11502.80	2.80	0.0187	11499.10	40.59	40.56
14500.00	14503.82	3.82	0.0255	14499.20	40.50	40.51
14500.00	14506.01	6.01	0.0401	14499.10	127.42	126.99
11500.00	11503.99	3.99	0.0266	11499.20	127.32	127.01
8500.00	8503.71	3.71	0.0247	8499.00	127.05	127.07
5500.00	5503.43	3.43	0.0229	5498.80	127.20	127.09
2500.00	2502.00	2.00	0.0134	2498.40	127.11	127.10
500.00	501.45	1.45	0.0097	498.10	127.25	127.14
500.00	501.27	1.27	0.0085	498.10	127.22	127.18
2500.00	2502.07	2.07	0.0138	2498.50	127.14	127.20
5500.00	5503.88	3.88	0.0258	5498.70	127.27	127.20
8500.00	8504.65	4.65	0.0310	8498.80	127.20	127.16
11500.00	11505.39	5.39	0.0359	11498.90	127.37	127.15
14500.00	14507.31	7.31	0.0487	14498.90	127.28	127.05

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

COMMENTS

Action 161983

COMMENTS

Operator: Western Refining Southwest LLC 539 South Main Street Findlay, OH 45840	OGRID: 267595
	Action Number: 161983
	Action Type: [UF-DP] Discharge Permit (DISCHARGE PERMIT)

COMMENTS

Created By	Comment	Comment Date
cchavez	Fall-Off Test (FOT) 2022: Placement into the Administrative Record as Required by EPA	11/29/2022
cchavez	FOT is not considered by EPA to be a MIT.	11/29/2022

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 161983

CONDITIONS

Operator: Western Refining Southwest LLC 539 South Main Street Findlay, OH 45840	OGRID: 267595
	Action Number: 161983
	Action Type: [UF-DP] Discharge Permit (DISCHARGE PERMIT)

CONDITIONS

Created By	Condition	Condition Date
cchavez	Fall-Off Test Currently under review by Reviewer Justin Wrinkle	11/29/2022