UIC - I - ___11___

EPA FALL-OFF TEST

2020

Submit 1 Copy To Appropriate District Office
District I – (575) 393-6161
1625 N. French Dr., Hobbs, NM 88240
District II – (575) 748-1283
811 S. First St., Artesia, NM 88210
District III – (505) 334-6178
1000 Rio Brazos Rd., Aztec, NM 87410
District IV – (505) 476-3460
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
Revised July 18, 2013

WELL API NO.
30-045-35747

5. Indicate Type of Lease
STATE ☐ FEE ☒

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS
(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name

1. Type of Well: Oil Well ☐ Gas Well ☒ Other Wastewater Disposal Well

8. Well Number: WDW #2

2. Name of Operator
Western Refining Southwest,,Inc.

9. OGRID Number 267595

3. Address of Operator
50 County Road 4990 (PO Box 159) Bloomfield, NM 87413

10. Pool name or Wildcat
Entrada

4. Well Location
Unit Letter H : 2028 feet from the North line and East feet from the line
Section 27 Township 29N Range 11W NMPM San Juan County

11. Elevation *(Show whether DR, RKB, RT, GR, etc.)*

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	☐	PLUG AND ABANDON	☐	REMEDIAL WORK	☐	ALTERING CASING	☐
TEMPORARILY ABANDON	☐	CHANGE PLANS	☐	COMMENCE DRILLING OPNS.	☐	P AND A	☐
PULL OR ALTER CASING	☐	MULTIPLE COMPL	☐	CASING/CEMENT JOB	☐		
DOWNHOLE COMMINGLE	☐						
CLOSED-LOOP SYSTEM	☐						
OTHER: Fall Off Test	☒			OTHER:	☐		

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 19.15.7.14 NMAC. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Pursuant to the Bloomfield Terminal Injection Well Discharge Permit (UICI-011), Western Refining Southwest, Inc. ("Western") is scheduled to perform a Fall-Off Test (FOT) on WDW #2. The fall-off test will consist of three phases:

- Phase 1: Build-Up
- Phase 2: Pressure Fall-Off Monitoring
- Phase 3: Post Monitoring Operations

Phase 1: Build-Up

The Build-Up Phase involves the injection of the Terminal's treated wastewaters into the well for 72 hours or until the injection pressure reaches the high-pressure set-point of 1,400 psi, whichever occurs first. A stabilized injection rate will be established using the dedicated injection well pump. Due to the limited time the injection well can operate before reaching the high-pressure set-point of 1,400 psi, tandem memory gauges will first be installed through the crown valve and lubricator using a slick-line unit. The gauges will be positioned at 7,312 ft below grade (reflective to the top of the injection interval). The memory gauges to be used are SP-2000 hybrid-quartz gauges provided by Tefteller, Inc. that will have a resolution of 0.01 psi and an accuracy of ± 0.05% of full scale. The pressure range of the gauges will be 0-5,000 psi minimum. The dedicated injection well will operate for 72-hours or until the discharge pressure approaches the 1,400 psi shutdown pressure following the placement of the tandem memory gauges to allow the gauges to stabilize. During this time, down-hole pressure readings will be recorded. Once the stabilization time has elapsed, the injection well pump will be shut down and the well will be blocked-in by closing the valve at the wellhead and in the pump room (double-block).

Phase 2: Pressure Fall-Off Monitoring

With the well blocked-in, bottom-hole readings will be recorded for a minimum of 3 days and up to 14 days. The recording period will be set to record pressures at a minimum of 5-minute intervals, with readings collected more frequently during the early part of the Fall-Off Test period.

Phase 3: Post Monitoring Operations

Following completion of the fall-off monitoring, the gauges will be pulled while making 5-minute stops at each 1,000 ft interval starting at 7,000 ft to collect pressure gradient readings. After removal of the gauges, the well will return to normal operation.

Upon receipt of NMOCD approval of this test protocol, Western will coordinate with NMOCD District III to provide the opportunity to witness all testing activities. The intent is to initiate field-testing activities on Friday, September 18th to ensure completion of field activities prior to September 30, 2020.

Spud Date: | Rig Release Date:

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Kelly Roberts TITLE Environmental Supervisor DATE 9/16/20

Type or print name _____ E-mail address: _____ PHONE: _____

For State Use Only

APPROVED BY: Carl J. Chavez TITLE Environmental Engineer DATE 9/17/2020

Conditions of Approval (if any):

1) Permittee shall gradually increase the injection flow rate and injection pressure over time to attain and achieve the appropriate steady-state condition below the permit MSIP before FOT monitoring.
2) If the Permittee is unable to achieve a steady-state condition before FOT monitoring, the test shall proceed in order to study and evaluate test results and provide observations, conclusions and final recommendations from the test based on operational conditions.
3) The Permittee shall ensure the perforated interval, borehole and the immediate injection interval is free from obstructions before the FOT.
4) The Permittee shall apply a pressure gauge with the resolution and accuracy requirements commensurate with the Fall-Off Test Plan requirements.
5) The Permittee shall provide notice of the dates and times for installation of any bottom hole gauge(s) start of FOT monitoring, bottom hole gauge recovery and MITs to the OCD District Office.

Submit 1 Copy To Appropriate District Office
District I – (575) 393-6161
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TEMPORARILY ABANDON	☐	CHANGE PLANS	☐	COMMENCE DRILLING OPNS.	☐	P AND A	☐
PULL OR ALTER CASING	☐	MULTIPLE COMPL	☐	CASING/CEMENT JOB	☐		
DOWNHOLE COMMINGLE	☐						
CLOSED-LOOP SYSTEM	☐						
OTHER	☐			OTHER:	☒	Bradenhead Test Report	

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 19.15.7.14 NMAC. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Pursuant to Condition 3.D.1 of the Bloomfield Terminal Injection Well Discharge Permit (UICI-011), Western Refining Southwest, Inc. conducted a pressure test on the Bradenhead and Intermediate casings of WDW #2 on Friday, September 18, 2020. A representative of NMOCD observed the testing via face-time in the field.

Spud Date: Rig Release Date:

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Kelly Robinson TITLE Environmental Supervisor DATE 09/18/2020

Type or print name Kelly Robinson E-mail address: krobinson3@marathonpetroleum.com PHONE: (505) 801-5616

For State Use Only

APPROVED BY: TITLE DATE

Conditions of Approval (if any):

NEW MEXICO ENERGY, MINERALS & NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
AZTEC DISTRICT OFFICE
1000 RIO BRAZOS ROAD
AZTEC NM 87410
(505) 334-6178 FAX: (505) 334-6170
http://emnrd.state.nm.us/ocd/District III/3distric.htm

BRADENHEAD TEST REPORT

(submit 1 copy to above address)

Date of Test 9-18-20 Operator Western Refining Southwest, Inc API #30-045-35747

Property Name Waste Disposal Well Well No. 2 Location: Unit H Section 27 Township 29 Range 11

Well Status(Shut-In or Producing) Initial PSI: Tubing 650 Intermediate Ø Casing Ø Bradenhead 43

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

PRESSURE

Testing	Bradenhead			INTERM	
	BH	Int	Csg	Int	Csg
TIME 5 min	Ø	Ø	Ø	Ø	Ø
10 min	Ø	Ø	Ø	Ø	Ø
15 min	Ø	Ø	Ø	Ø	Ø
20 min					
25 min					
30 min					

Ø = zero

FLOW CHARACTERISTICS

	BRADENHEAD	INTERMEDIATE
Steady Flow		
Surges		
Down to Nothing	✓	✓
Nothing		
Gas	✓	✓
Gas & Water		
Water		

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR_____ FRESH_____ SALTY_____ SULFUR_____ BLACK_____

5 MINUTE SHUT-IN PRESSURE BRADENHEAD Ø (Light puff when opened after 5 minutes) INTERMEDIATE Ø

REMARKS: The intermediate and bradenhead have not been opened prior to testing. Bradenhead pressure to 0psi in 4 seconds. Intermediate to Ø psi in 14 seconds. Intermediate had no puff after 5 minute shut-in.

By Kelly Robinson & Frank Dooley Witness Monica Kuehling (Via Face-Time)

WNR Personnel
(Position)

E-mail address Krobinson3@marathonpetroleum.com

2020 ANNUAL BOTTOM-HOLE PRESSURE SURVEY AND PRESSURE FALLOFF TEST REPORT WESTERN REFINING SOUTHWEST, INC.

WASTE DISPOSAL WELL NO. 2

Bloomfield, New Mexico

November 2020

Houston, TX

Project No. 192143A

Prepared by Larry McDonald Reviewed by Jeffry Tahtouh

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

WSP USA Inc. (WSP) was contracted by Western Refining Southwest Inc. (Western) to conduct the analysis of the annual bottom-hole pressure survey and pressure falloff test on Western's Waste Disposal Well No. 2 (WDW#2). The test was performed according to New Mexico Oil Conservation Division (OCD) falloff test guidelines (*New Mexico Oil Conservation Division UIC Class I Well Fall-Off Test Guidance, December 3, 2007*).

The test provides the state regulatory agency with the necessary information to access the validity of requested or existing injection well permit conditions and satisfy the permitting objective of protecting the underground sources of drinking water (USDW). Specifically, 40 CFR Part 146 states "the Director shall require monitoring of the pressure buildup in the injection zone annually, including at a minimum, a shutdown of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve" (40 CFR§146.13 for Non-hazardous Class I Wells).

The falloff testing was conducted according to the testing plan submitted to and approved by the NM OCD.

As prescribed by the guidelines, the report discusses supporting and background information in Sections 1 through 9. The one-mile area of review (updated since the 2019 falloff testing) is discussed in Section 10 and geology in Section 11. Information on the offset wells is discussed in Section 12, daily testing activities in Section 13. The pressure falloff testing and analysis results are discussed in Section 14. The OCD required record keeping statement is discussed in Section 15.

1. FACILITY INFORMATION

a. Name: Western Refining Southwest, Inc. (subsidiary of the Marathon Petroleum Company)
b. Facility Location: 50 County Road 4990 (PO Box 159) Bloomfield, New Mexico 87413
c. Operator's Oil and Gas Remittance Identifier (OGRID) Number: 267595

2. WELL INFORMATION

a. OCD UIC Permit Number: UICI-011
b. Well Classification: Class I Non-hazardous
c. Well Name and Number: WDW#2
d. API Number: 30-045-35747
e. Well Legal Location: 2028' FNL and 111' FEL, Unit letter H of Section 27, Township 29 North, Range 11 West

3. CURRENT WELLBORE SCHEMATIC

The WDW#2 wellbore schematic is presented in Figure 1. The schematic contains data, as requested by the guidelines and includes the following:

a. Tubing: 4-1/2-inch, 11.6 pound per foot, API grade L-80, with Internal Plastic Coated (IPC) casing, set at 7230 feet

b. Packer: Baker, 7-inch by 4-1/2-inch set at 7230 feet.

c. Size, Type, and Depth of Casing: There are three casing strings in the well. The information for these casing strings was obtained from OCD records on file with the state and geophysical logs. The casing strings are:

   i. 13-3/8-inch, 48 pound per foot, steel construction, API grade H40, set at a depth of 298 feet. The casing was cemented to the surface with 394 sacks of cement. The casing was set in open hole with a diameter of 17.5 inches.

   ii. 9-5/8-inch, 36 pound per foot, steel construction, API grade J-55, set at a depth of 3500 feet. The casing was cemented to the surface with 857 sacks of cement. The casing was set in open hole with a diameter of 12.25 inches.

   iii. 7-inch, 26 pound per foot and 23 pound per foot, steel construction, API grade L-80, set at a depth of 7525 feet. The casing was cemented to surface with 868 sacks of cement. The casing was set in open hole with a diameter of 8.75 inches.

4. ELECTRIC LOG ENCOMPASSING THE COMPLETED INTERVAL

The dual induction log is presented in Appendix A and encompasses the completed interval between 7200 feet and 7532 feet. The dual induction log was submitted to the OCD with the original permit after the well was drilled.

5. RELEVANT PORTIONS OF THE POROSITY LOG USED TO ESTIMATE FORMATION POROSITY

The porosity log is presented in Appendix B and encompasses the completed interval between 7200 feet and 7532 feet. The neutron density log was submitted to the OCD with the original permit after the well was drilled. The porosity of the formation, 14.9%, and the reservoir thickness, 123 feet, were determined from this log. These values were used in the analysis of the pressure falloff data (Section 15). Additional information concerning the geology of the injection reservoir is discussed in Section 11.

6. PVT DATA OF THE FORMATION AND INJECTION FLUID

The fluid used for the injection test is the terminal treated wastewater (effluent). A current effluent analysis collected on July 13, 2020 and August 17, 2020 is included in Appendix C. A summary of the formation water is also in Appendix C. The formation water analyses taken on January 25, 2017 is included.

7. DAILY RATE HISTORY DATA (MINIMUM OF ONE MONTH PRECEDING THE FALLOFF TEST)

The rate history used in the analysis of the pressure falloff data began on May 28, 2020 and ends when the well was shut-on September 21, 2020. The daily rate history is summarized in Appendix D.

8. CUMULATIVE INJECTION INTO THE FORMATION FROM TEST WELL

The total volume of fluid injected into the WDW#2 was 6,738,018 gallons. The injected volumes were obtained from NMOCD online records.

9. PRESSURE GAUGES

Two (2) downhole pressure gauges were used for the WDW-2 buildup and falloff testing. The downhole pressure gauge was set at 7312 feet, ground level.

a. Describe the type of downhole surface pressure readout gauge used including manufacture and type:

   An MRO pressure gauge was used to monitor the bottom-hole pressure and temperature during the pressure buildup and falloff testing. The gauge was a sapphire crystal gauge with Serial No.240. The gauges are manufactured by Micro-Smart.

b. List the full range, accuracy and resolution of the gauge:

The MRO pressure gauge, Serial No. 240, has a full range of 14.73 psi to 5000 psi and an accuracy of 0.05% of full scale.

c. Provide the manufacturer's recommended frequency of calibration and a calibration certificate showing date the gauge was last calibrated:

The certificates of calibration for the pressure gauge used during the testing are included as Appendix E. The pressure gauge was last calibrated on March 10, 2020 and is within the recommended calibration frequency as recommended by Micro-Smart.

10. ONE MILE AREA OF REVIEW (AOR)

Federal Abstract Company was contracted by WSP to undertake a review of well changes made within a one-mile area of review (AOR) of WDW#2. The current update of the one-mile area of review includes all existing wells within the one-mile AOR and any changes that have occurred to these wells since the 2019 update.

No new freshwater wells were reported within the search area since the submittal of the 2019 report.

a. Identify wells located within the one-mile AOR:

There are 62 wells in the one-mile radius of investigation. Table 1 contains a listing of all wells within the one-mile AOR of WDW#2. Figure 2 is a base map of the area containing the one-mile AOR.

b. Ascertain the status of wells within the one-mile AOR:

Table 1 also contains a listing of all wells within the one-mile AOR, with their current status. Tables 2 through 6 contain a list of all wells within the one-mile AOR that have had modifications to the current permit or have had new drilling and/or completion permits issued since the 2019 pressure falloff report.

Five (5) additional wells were found in the AOR that were not identified in the previous reports. They can be found in the Table 1 and are numbered 58 through 62. Ten (10) wells were found in which the owner had changed. Three (3) wells were found in which the permit was cancelled. Five (5) new wells were plugged and abandoned. No wells were placed in temporarily abandoned status. No wells were found that were returned to production status. No wells were found that had been recompleted.

No new wells were drilled and no permits were issued to drill new wells. All plugged and abandoned wells were successfully plugged and isolated from the WDW#2 injection interval according to current OCD records.

c. Provide details on any offset producers and injectors completed in the same interval:

One of the sixty-two wells in the AOR, Ashcroft SWD #1, penetrates the Entrada injection zone. This well is 0.64 miles from the disposal well and is an active water disposal well. Ashcroft SWD #1 is listed as ID No. 24 in Table 1 and no changes have occurred to this well. No wells are currently producing form the Entrada injection zone within the AOR.

11. GEOLOGY

The injection zone is the Entrada sandstone formation. The formations occur in WDW #2 at the depths shown in the table below. The injection zone is shown in WDW #2 logs in Appendices A and B.

Injection Zone Formation	Waste Disposal Well #2 (KB elev = 5,550 ft)	
	MD below KB (ft)	SS Depth (ft)
Bluff Sandstone	Not completed	7,031
Entrada Sandstone	7,312 to 7,470	7,308

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 its margin as step cliffs. The Entrada unconformably overlies the Chinle Formation. The Todilto Formation made up of limestone and anhydrite in dense and thought to an impermeable barrier or seal and likely seal for the injection zone.

The Entrada Sandstone consists of mottled reddish-brown very fine to medium grained wellsorted, 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 crossstratified sandstone is competent, laterally persistent and with homogenous reservoir properties. Entrada Sandstone gross thickness ranges from 60 feet to 330 feet across the basin.

At the WDW #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 many of the density porosities are greater than 10 percent. WDW #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 14.9 percent porosity. Permeability for the well as measured by this falloff test is 1.14 md or less.

12. OFFSET WELLS

The offset well is discussed in Section 10.0.

13. CHRONOLOGICAL LISTING OF THE DAILY TESTING ACTIVITIES

a. Date of the testing:

The buildup portion of the testing started on September 18, 2020 at 1334 hours and continued until September 21, 2020 at 1424 hours when WDW-2 was shut-in. The falloff test ended on October 1, 2020 at 0802 hours. Five-minute gradient stops were made at 1000-foot intervals while pulling the pressure gauges out of the well. After the pressure gauges were pulled out of the well, the well was turned over to Western plant operations personnel.

b. Time of the injection period:

The buildup portion of the testing began on September 18, 2020 when the injection rate was set at an average injection rate of approximately 22 gallons per minute (gpm). The bottom-hole pressure and temperature were monitored for 72.83 hours after which time the well was shut in.

c. Type of injection fluid:

The injected fluid was non-hazardous wastewater from the plant. The density of the injection fluid averaged 8.33 pounds per gallon during the test.

d. Final injection pressure and temperature prior to shutting in the well:

The final flowing pressure feet (P_{wf}) and temperature (T_{wf}) were 4479.71 psia and 181.71°F, respectively.

e. Total shut-in time:

WDW-2 was shut-in for 234 hours.

f. Final static pressure and temperature at the end of the fall-off portion of the test:

The final static pressure (P_{static}) and temperature (T_{static}) were 3750.78 psia and 184.46°F, respectively.

14. PRESSURE FALLOFF ANALYSIS

The following discussion of the analysis of the pressure data recorded during the falloff testing of WDW- 2 satisfies Sections 15 through 19 of Section IX, Report Components, of the OCD's falloff test guidelines. Where appropriate, the specific guideline addressed is annotated. Specific parameters used in the equations and discussed previously in this report are also annotated. The plots included with this report are summarized in Table 7. The inclusion of these plots in this report satisfies OCD Guideline Section IX.18.

The pressure data obtained during the falloff test were analyzed using the commercially available pressure transient analysis software program PanSystem©. Appendix F contains the output from this software program. Figure 3 shows the pressure data recorded by the bottom-hole pressure gauge from the time the tool was in place through the 234-hour shut-in period. Figure 4 is a Cartesian plot of the pressure data recorded during the falloff period.

Figure 5 is the derivative log-log diagnostic plot of the falloff data, showing change in pressure and pressure derivative versus elapsed shut-in time. The different flow regimes, wellbore storage, fracture bilinear flow, pseudo-radial flow and change in reservoir characteristics if present, are indicated on the log-log plot and the superposition Horner plot (OCD Guideline Section IX.18.c and IX.18.d).

Wellbore storage begins at 0.036 hours and continues to an elapsed shut in time of 0.052 hours. The bi- linear flow period begins at an elapsed shut-in time of 0.488 and continues until an elapsed shut-in time of 1.10 hours. The linear flow period was not apparent on the 2020 derivative log-log plot as was seen on the 2019 pressure falloff analysis report. Although the pseudo-radial flow period is not fully developed, it gives a good determination of the reservoir permeability. The pseudo-radial flow period begins at an elapsed shut in time of 153.77 hours and continues to an elapsed time of 233.94 hours. (OCD Guideline Section IX.15.b).

The reservoir permeability was determined from the pseudo-radial flow region of the superposition semi-log plot, Figure 6. The superposition time function was used to account for all rate changes during the injection period used in the analysis of the data. The pseudo-radial flow regime begins at a Superposition time of 1.96 and continues to 1.76. Figure 7 shows an expanded view of the pseudo-radial flow regime. The slope of the radial flow period, as calculated by the analysis software, was 482.305 psi/cycle (OCD Guideline Section IX.15.c). The injection rate just prior to shut in was 24 gpm which is equivalent to 882.86 barrels per day (bbls/day).

An estimate of mobility-thickness (transmissibility, OCD Guideline Section IX.15.d), kh/μ, for the reservoir was determined to be 297.64 md-ft/cp using the following equation:

$$\frac{k\,h}{\mu} = 162.6\,\frac{q\,B}{m}$$

where,

kh/μ	=	formation mobility-thickness, millidarcy-feet/centipoise
q	=	rate prior to shut in, bpd
B	=	formation volume factor, reservoir volume/surface volume
m	=	slope of radial flow period, psi/cycle

$$\frac{kh}{\mu} = 162.6 \frac{(882.86)(1.0)}{482.305}$$

$$= 297.64 \text{ md-ft/cp}$$

The permeability-thickness (flow capacity, OCD Guideline Section IX.15.i), kh, was determined to be 138.89 md-ft by multiplying the mobility-thickness, kh/μ, by the viscosity of the reservoir fluid (see Section 6), $\mu_{reservoir}$, of 0.47 centipoise (cp):

$$kh = \frac{(kh)}{\mu} \mu_{reservoir}$$

$$= (297.64)(0.47)$$

$$= 139.89 \text{ md-ft}$$

The reservoir permeability (OCD Guideline Section IX.15.e) using the total thickness (see Section 5 and Section 11) of 123 feet was 1.14 md:

$$k = \frac{kh}{h}$$

$$= \frac{139.89}{123}$$

$$= 1.14 \text{ md}$$

To determine whether the proper viscosity was used in arriving at this permeability, the travel time for a pressure transient to pass beyond the waste front needs to be calculated (OCD Guideline Section VIII.5). The distance to the waste front is determined from the following equation:

$$r_{waste} = \left(\frac{0.13368\, V}{\pi\, h\, \Phi}\right)^{1/2}$$

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

A cumulative volume of approximately 6,738,018 gallons of waste has been injected into WDW-2 (see Section 8). The formation has a porosity of 0.149 (see Section 5 and Section 11).

The distance to the waste front was determined to be 125.08 feet:

$$r_{waste} = \left(\frac{(0.13368)(\ 6738018)}{\pi\ (123)(0.149)}\right)^{1/2}$$

$$= 125.08 \text{ feet}$$

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

$$t_{waste} = 948\frac{\Phi\ \mu_{waste}\ c_t\ r_{waste}^2}{k}$$

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

The pore volume compressibility is 4.44 x 10^{-6} psi^{-1} (see Section 6). The viscosity of the waste fluid is 0.47 cp (see Section 6). The time necessary for a pressure transient to traverse the distance from the wellbore to the leading edge of the waste front would be 4.04 hours:

$$t_{waste} = 948\frac{(0.149)(0.47)(4.44x10^{-6})(125.08)^2}{1.14}$$

$$= 4.04 \text{ hours}$$

Since the time required to pass through the waste is less than the 153.77 hours required to reach the beginning of the radial flow period, the assumption that the pressure transient was traveling through reservoir fluid during the period of the semi-log straight line was correct.

The near wellbore skin damage (OCD Guideline Section IX.15.f) was determined from the following equation:

$$s = 1.151\left[\frac{p_{wf} - p_{1hr}}{m_1} - \log\left(\frac{k}{\phi\ \mu\ c_t\ r_w^2}\right) + 3.23\right]$$

where,

s	=	formation skin damage, dimensionless
1.151	=	constant
p_{wf}	=	flowing pressure immediately prior to shut in, psi

p_{1hr}	=	pressure determined from extrapolating the first radial flow semi-log line to a Δt of one hour, psi
m_1	=	slope of the first radial flow semi-log line, psi/cycle
k	=	permeability of the formation, md
ϕ	=	porosity of the injection interval, fraction
μ	=	viscosity of the fluid the pressure transient is traveling through, cp
c_t	=	total compressibility of the formation plus fluid, psi^{-1}
r_w	=	radius of the wellbore, feet
3.23	=	constant

The final measured flowing pressure was 4479.71 psia. The pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, p_{1hr}, was 4522.64 psia (calculated from the analysis software). The wellbore radius, r_w, is 0.3281 feet (completion records). Using these values in addition to the previously discussed parameters results in a skin of -5.05:

$$s = 1.151\left[\frac{4479.71 - 4522.64}{482.305} - \log\left(\frac{1.14}{(0.149)(0.47)(4.44x10^{-6})(0.3281^2)}\right) + 3.23\right]$$

$$= -5.05$$

The change in pressure, Δp_{skin}, in the wellbore associated with the skin factor (OCD Guideline Section IX.15.g) was calculated using the following equation:

$$\Delta p_{skin} = 0.869(m)(s)$$

where,

0.869	=	constant
m	=	slope from superposition plot of the well test, psi/cycle
s	=	skin factor calculated from the well test

The change in pressure, Δp_{skin}, using the previously calculated and defined values was determined to be -2117 psi:

$$\Delta p_{skin} = 0.869(m)(s)$$

$$= 0.869\ (482.305)(-5.05)$$

$$= -2117\ psi$$

The flow efficiency (E, OCD Guideline Section IX.15.h) was determined from the following equation:

$$E = \frac{p_{wf} - \Delta p_{skin} - p_{static}}{p_{wf} - p_{static}}$$

where,

E	=	flow efficiency, fraction
p_{wf}	=	flowing pressure prior to shutting in the well for the fall-off test,
p_{static}	=	final pressure from the pressure falloff test
Δp_{skin}	=	pressure change due to skin damage

Using the previously determined parameters, the flow efficiency was calculated to be 3.91:

$$E = \frac{4479.71 - (-2117) - 3750.78}{4479.40 - 3750.78}$$

$$= 3.91$$

The radius of investigation (OCD Guideline Section IX.15.a) was calculated using the following equation:

$$R_{inv} = 0.029 \sqrt{\frac{k\,\Delta ts}{\phi\,\mu\,Ct}}$$

The radius of investigation, r_{inv}, using the previously defined values was determined to be 849 feet:

$$R_{inv} = 0.029 \sqrt{\frac{(1.14)(234)}{(0.149)(0.47)(4.44 \times 10^{-6})}}$$

$$R_{inv} = 849 \text{ feet}$$

As indicated on Figure 5, the pressure data does not depart the pseudo-radial flow region. No pressure or temperature anomalies were noted on any of the analysis plots (OCD Guideline Section VIII.9 and IX17.b).

Because WDW-2 was shut in approximately 1915 hours prior to the 2020 pressure falloff testing, a current Hall plot (OCD Guideline Section IX.18.h) could not be constructed.

A comparison of the 2020 and 2019 reservoir analysis results are available in Table 8 (OCD Guideline Section IX.19).

On October 1, 2020, a static pressure gradient survey was conducted while pulling the pressure gauges out of the well. Static gradient stops were conducted at 7312 feet, 7000 feet, 6000 feet,

5000 feet, 4000 feet, 3000 feet, 2000 feet, 1000 feet, and at the surface. The bottom-hole pressure and temperature, after 234 hours of shut-in at 7312 feet were 3750.78 psia and 184.46°F, respectively. The gradient survey is summarized in Table 8. The data are graphically depicted in Figure 8.

15. NEW MEXICO OIL CONSERVATION DIVISION THREE YEAR RECORDING KEEPING STATEMENT

Western will keep the raw test data, generated during the testing, on file for a minimum of three years. The raw test data will be made available to OCD upon request.

TABLES

TABLE 1

TABULATION OF WELLS WITHIN ONE MILE AREA OF REVIEW FOR WASTE DISPOSAL WELL NO. 2

Map ID	Distance (ft)	API No	Co	Lease	Well No	Total Depth	ULSTR	Type	Status	Plug Date	Penetrate Injection Zone
0	0	30-045-35747	Western Refining Southwest, Inc.	Waste Disposal Well	2	7525	H-27-29N-11W	SWD	Active		Y
1	1041	30-045-34409	Holcomb Oil & Gas Inc	Jacque	2	1897	H-27-29N-11W	Gas	Active		N
2	1141	30-045-24084	Hilcorp Energy Co	Davis Gas Com F	001E	6392	H-27-29N-11W	Gas	Active		N
3	1170	30-045-07883	Pre-Ongard Well Operator	Pre-Ongard Well	2	0	H-27-29N-11W	Gas	Plugged	12/31/1901	N
4	1380	30-045-29002	San Juan Refining Co	Disposal	1	3601	I-27-29N-11W	SWD	Plugged	10/29/2015	N
5	1582	30-045-30833	Hilcorp Energy Co	Davis Gas Com F	001R	6700	I-27-29N-11W	Gas	Active		N
6	1643	30-045-25329	Holcomb Oil & Gas Inc	Davis Gas Com J	1	4331	F-26-29N-11W	Gas	Active		N
7	1693	30-045-24083	Hilcorp Energy Co	Sullivan Gas Com D	001E	6329	F-26-29N-11W	Gas	Active		N
8	1740	30-045-07825	Bp America Production Co	Davis Gas Com F	1	6365	I-27-29N-11W	Gas	Plugged	1/19/1994	N
9	1742	30-045-23554	XTO Energy, Inc	Davis Gas Com G	1	2951	I-27-29N-11W	Gas	Plugged	11/15/2011	N
10	1756	30-045-34463	Holcomb Oil & Gas Inc	Jacque	1	1890	I-27-29N-11W	Gas	Active		N
11	1793	30-045-07812	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	I-27-29N-11W	Gas	Plugged	11/3/1982	N
12	2376	30-045-12003	Hilcorp Energy Co	Calvin	1	6450	M-26-29N-11W	Gas	Active		N
13	2640	30-045-02133	N/A	Lauren Kelly	1	3028	27-29N-11W	N/A	Inactive		N
14	2640	30-045-02134	N/A	B Garland	1	3028	27-29N-11W	N/A	Inactive		N
15	2713	30-045-34266	Holcomb Oil & Gas Inc	Mangum	001S	0	F-27-29N-11W	Gas	Cancelled	12/31/9999	N
16	2750	30-045-25612	Hilcorp Energy Co	Calvin	3	5970	K-26-29N-11W	Oil	Active		N
17	2904	30-045-31118	Hilcorp Energy Co	Calvin	100	1970	N-26-29N-11W	Gas	Active		N
18	2909	30-045-07776	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	M-26-29N-11W	Gas	Plugged	12/31/1901	N
19	3018	30-045-26721	Manana Gas Inc	Nancy Hartman	2	2824	P-22-29N-11W	Gas	Active		N
20	3025	30-045-24572	Morningstar Operating Llc	Congress	9	2960	N-26-29N-11W	Gas	Active		N
21	3121	30-045-07733	Hilcorp Energy Co	Sullivan Gas Com D	1	6260	B-26-29N-11W	Gas	Active		N
22	3146	30-045-07961	Manana Gas Inc	Hartman	1	6310	P-22-29N-11W	Gas	Plugged	6/14/1999	N
23	3391	30-045-07959	John C Pickett	Grace Pearce	1	1620	O-22-29N-11W	Gas	Plugged	3/2/2000	N
24	3412	30-045-30788	Hilcorp Energy Co	Ashcroft Swd	1	7512	B-26-29N-11W	SWD	Active		Y
25	3451	30-045-25673	Hilcorp Energy Co	Congress	18	6150	K-27-29N-11W	Oil	Active		N
26	3498	30-045-24673	Hilcorp Energy Co	Mangum	001E	6240	F-27-29N-11W	Gas	Active		N
27	3597	30-045-33093	Hilcorp Energy Co	Calvin	001F	6525	J-26-29N-11W	Gas	Active		N

TABLE 1

TABULATION OF WELLS WITHIN ONE MILE AREA OF REVIEW FOR WASTE DISPOSAL WELL NO. 2

Map ID	Distance (ft)	API No	Co	Lease	Well No	Total Depth	ULSTR	Type	Status	Plug Date	Penetrate Injection Zone
28	3645	30-045-27365	Manana Gas Inc	Marian S	1	2840	F-27-29N-11W	Gas	Active		N
29	3654	30-045-27361	Manana Gas Inc	Lauren Kelly	1	1500	F-27-29N-11W	Gas	Active		N
30	3803	30-045-29107	Pre-Ongard Well Operator	Pre-Ongard Well	001X	0	G-26-29N-11W	Gas	Plugged	7/28/1955	N
31	3805	30-045-07870	Pre-Ongard Well Operator	Pre-Ongard Well	00X	0	G-26-29N-11W	Gas	Plugged	7/1/1953	N
32	3836	30-045-07896	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	C-27-29N-11W	Gas	Plugged	11/27/1978	N
33	3874	30-045-23163	Hilcorp Energy Co	Earl B Sullivan	1	2861	B-26-29N-11W	Gas	Active		N
34	3907	30-045-25657	Hilcorp Energy Co	Congress	16	6200	A-34-29N-11W	Oil	Active		N
35	3936	30-045-23550	Holcomb Oil & Gas Inc	State Gas Com Bs	1	2954	K-23-29N-11W	Gas	Active		N
36	3963	30-045-07985	Bp America Production Co	Pearce Gas Com	1	6230	K-23-29N-11W	Gas	Plugged	3/12/1997	N
37	4155	30-045-07835	Holcomb Oil & Gas Inc	Mangum	1	6350	L-27-29N-11W	Gas	Active		N
38	4199	30-045-26731	Manana Gas Inc	Mary Jane	1	2845	N-22-29N-11W	Gas	Active		N
39	4192	30-045-24574	Hilcorp Energy Co	Summit	9	2985	A-34-29N-11W	Gas	Active		N
40	4209	30-045-34312	Manana Gas Inc	Royal Flush	1	2045	N-22-29N-11W	Gas	Active		N
41	4364	30-045-07940	Manana Gas Inc	Cook	1	6305	N-22-29N-11W	Gas	Active		N
42	4391	30-045-13089	Manana Gas Inc	Cook	2	1440	N-22-29N-11W	Gas	Active		N
43	4587	30-045-07868	Holcomb Oil & Gas Inc	Sullivan	2	1478	H-26-29N-11W	Gas	Active		N
44	4583	30-045-08009	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	K-23-29N-11W	Gas	Plugged	8/26/1980	N
45	4649	30-045-25675	Hilcorp Energy Co	Congress	15	6030	C-35-29N-11W	Oil	Active		N
46	4722	30-045-21457	Morningstar Operating Llc	Delo	10	2900	I-26-29N-11W	Gas	Active		N
47	4736	30-045-25707	Morningstar Operating Llc	Summit	15	6216	C-34-29N-11W	Gas	Active		N
48	4773	30-045-07903	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	M-27-29N-11W	Gas	Plugged	7/1/1975	N
49	4816	30-045-24573	Morningstar Operating Llc	Garland	3	2905	M-27-29N-11W	Gas	Active		N
50	4897	30-045-25195	Hilcorp Energy Co	Calvin	2	5950	P-26-29N-11W	Oil	Active		N
51	4908	30-045-24772	Hilcorp Energy Co	Calvin	001E	6500	P-26-29N-11W	Gas	Active		N
52	4983	30-045-21732	Burlington Resources O&G Co Lp	Garland B	001R	1810	M-27-29N-11W	Gas	Plugged	8/9/2010	N
53	5038	30-045-25621	Holcomb Oil & Gas Inc	Earl B Sullivan	2	5751	H-26-29N-11W	Oil	Active		N
54	5056	30-045-24837	Hilcorp Energy Co	Congress	004E	6508	E-35-29N-11W	Gas	Active		N
55	5133	30-045-20752	Chaparral Oil & Gas Co	Lea Ann	1	1900	E-35-29N-11W	Gas	Plugged	12/18/1999	N

TABLE 1

TABULATION OF WELLS WITHIN ONE MILE AREA OF REVIEW FOR WASTE DISPOSAL WELL NO. 2

Map ID	Distance (ft)	API No	Co	Lease	Well No	Total Depth	ULSTR	Type	Status	Plug Date	Penetrate Injection Zone
56	5165	30-045-22639	General Minerals Corp	Delo	11	1945	P-26-29N-11W	Gas	Plugged	7/30/2010	N
57	5221	30-045-24082	Hilcorp Energy Co	Pearce Gas Com	001E	6365	J-23-29N-11W	Gas	Active		N
58	703	30-045-25745	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	E-26-29N-11W	Gas	Cancelled		N
59	1129	30-045-23553	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	H-27-29N-11W	Gas	Plugged		N
60	1658	30-045-23552	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	F-26-29N-11W	Gas	Cancelled		N
61	4766	30-045-23551	Pre-Ongard Well Operator	Pre-Ongard Well	1	0	O-23-29N-11W	Gas	Cancelled		N
62	4894	30-045-25738	Pre-Ongard Well Operator	Pre-Ongard Well	23	0	I-26-29N-11W	Gas	Cancelled		N

TABLE 2

WELL CHANGES IN THE AREA OF REVIEW

Unit	Sect	Twp	Rng	Map ID	Well Name	Operator	Changes	Change of Owner	P&A	T&A	Recomp	New	Cancelled
H	27	29N	11W	2	Davis Gas Com F	Davis Gas Com F	Owner	[X]					
H	27	29N	11W	3	Pre-Ongard Well	Pre-Ongard Well	P&A		[X]				
I	27	29N	11W	5	Davis Gas Com F	Davis Gas Com F	Owner	[X]					
F	26	29N	11W	7	Sullivan Gas Com D	Sullivan Gas Com D	Owner	[X]					
F	27	29N	11W	15	Mangum	Mangum	P&A		[X]				
M	26	29N	11W	18	Pre-Ongard Well	Pre-Ongard Well	P&A		[X]				
B	26	29N	11W	21	Sullivan Gas Com D	Sullivan Gas Com D	Owner	[X]					
B	26	29N	11W	24	Ashcroft Swd	Ashcroft Swd	Owner	[X]					
C	27	29N	11W	32	Pre-Ongard Well	Pre-Ongard Well	P&A		[X]				
B	26	29N	11W	33	Earl B Sullivan	Earl B Sullivan	Owner	[X]					
I	26	29N	11W	46	Delo	Delo	Owner	[X]					
C	34	29N	11W	47	Summit	Summit	Owner	[X]					
M	27	29N	11W	49	Garland	Garland	Owner	[X]					
J	23	29N	11W	57	Pearce Gas Com	Pearce Gas Com	Owner	[X]					
E	26	29N	11W	58	Pre-Ongard Well	Pre-Ongard Well Operator	Cancelled						[X]
H	27	29N	11W	59	Pre-Ongard Well	Pre-Ongard Well Operator	P&A		[X]				
F	26	29N	11W	60	Pre-Ongard Well	Pre-Ongard Well Operator	Cancelled						[X]
O	23	29N	11W	61	Pre-Ongard Well	Pre-Ongard Well Operator	Cancelled						[X]
I	26	29N	11W	62	Pre-Ongard Well	Pre-Ongard Well Operator	Cancelled						[X]

TABLE 3

WELLS THAT HAVE BEEN PLUGGED AND ABANDONED SINE THE 2019 AOR UPDATE

Unit	Sect	Twp	Rng	Map ID	API No	Well Name	Operator	Change of Owner	P&A	T&A	Prod	Recomp	New
H	27	29N	11W	3	30-045-07883	Pre-Ongard Well	Pre-Ongard Well		[X]				
F	27	29N	11W	15	30-045-34266	Mangum	Mangum		[X]				
M	26	29N	11W	18	30-045-07776	Pre-Ongard Well	Pre-Ongard Well		[X]				
C	27	29N	11W	32	30-045-07896	Pre-Ongard Well	Pre-Ongard Well		[X]				
H	27	29N	11W	59	30-045-23553	Pre-Ongard Well	Pre-Ongard Well		[X]				

TABLE 4

WELLS THAT HAVE BEEN TEMPORARILY ABANDONED SINCE THE 2019 AOR UPDATE

Unit	Sect	Twp	Rng	Map ID	API No	Well Name	Operator	Change of Owner	P&A	T&A	Prod	Recomp	New

NO CHANGES

TABLE 5

WELLS THAT HAVE BEEN RECOMPLETED SINCE THE 2019 AOR UPDATE

Unit	Sect	Twp	Rng	Map ID	API No	Well Name	Operator	Change of Owner	P&A	T&A	Prod	Recomp	New

NO CHANGES

TABLE **6**

NEWLY DRILLED WELLS SINCE THE 2019 AOR UPATE

Unit	Sect	Twp	Rng	Map ID	API No	Well Name	Operator	Change of Owner	P&A	T&A	Prod	Recomp	New

NO CHANGES

TABLE 7

FIGURES INCLUDED IN THE REPORT

Figure	Description	OCD Reference
1	Waste Disposal Well #2 Schematic	Section VI.1 and IX.3
2	Map of One Mile Area of Review	n/a
3	Waste Disposal Well #2 Test Overview	Section IX.18.f
4	Waste Disposal Well #2 Cartesian Plot of Data Used in the Analysis	Section IX.18.a
5	Waste Disposal Well #2 Derivative Log-Log Plot	Section IX.18.c
6	Waste Disposal Well #2 Superposition Horner (Semi-Log) Plot	Section IX.18.d
7	Waste Disposal Well #2 Expanded Superposition Horner (Semi-Log) Plot	Section IX.18.d
8	Waste Disposal Well #2 Static Pressure Gradient Survey	n/a

TABLE 8

Waste Disposal Well #2
Comparison of Permeability, Transmissibility, Skin, False Extrapolated Pressure, and Fill Depth

Date of Test	Permeability (k)	Mobility-Thickness (kh/u)	Skin (s)	False Extrapolated Pressure (p*)
September 21 to October 1, 2020	1.14 md	297.64 md-ft/cp	-5.05	3632.37 psia
April 15 – 30, 2019	1.73 md	451 md-ft/cp	-3.80	3809.70 psia

TABLE 9

STATIC PRESSURE GRADIENT SURVEY
WASTE DISPOSAL WELL No. 2
OCTOBER 1, 2020

Memory Gauge Serial No. 1243			
Depth (feet)	Pressure (psig)	Pressure Gradient (psi/ft)	Temperature (ºF)
0	587.92	-	65.86
1000	1024.54	0.437	75.71
2000	1437.63	0.413	95.25
3000	1888.65	0.451	112.31
4000	2319.81	0.431	131.73
5000	2749.02	0.429	149.61
6000	3176.71	0.428	177.27
7000	3603.32	0.427	187.23
7312	3736.08	0.426	184.46

FIGURES

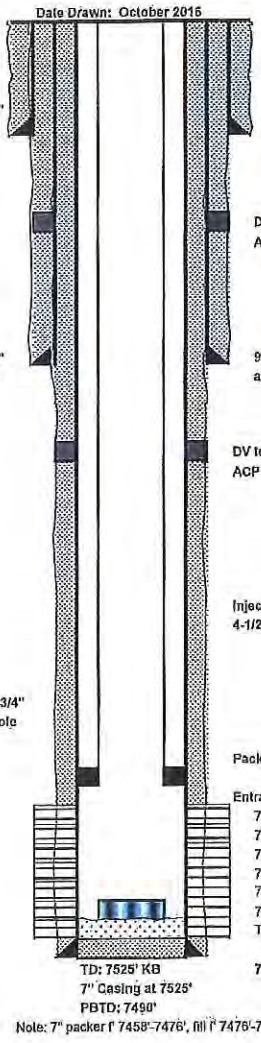
FIGURE 1

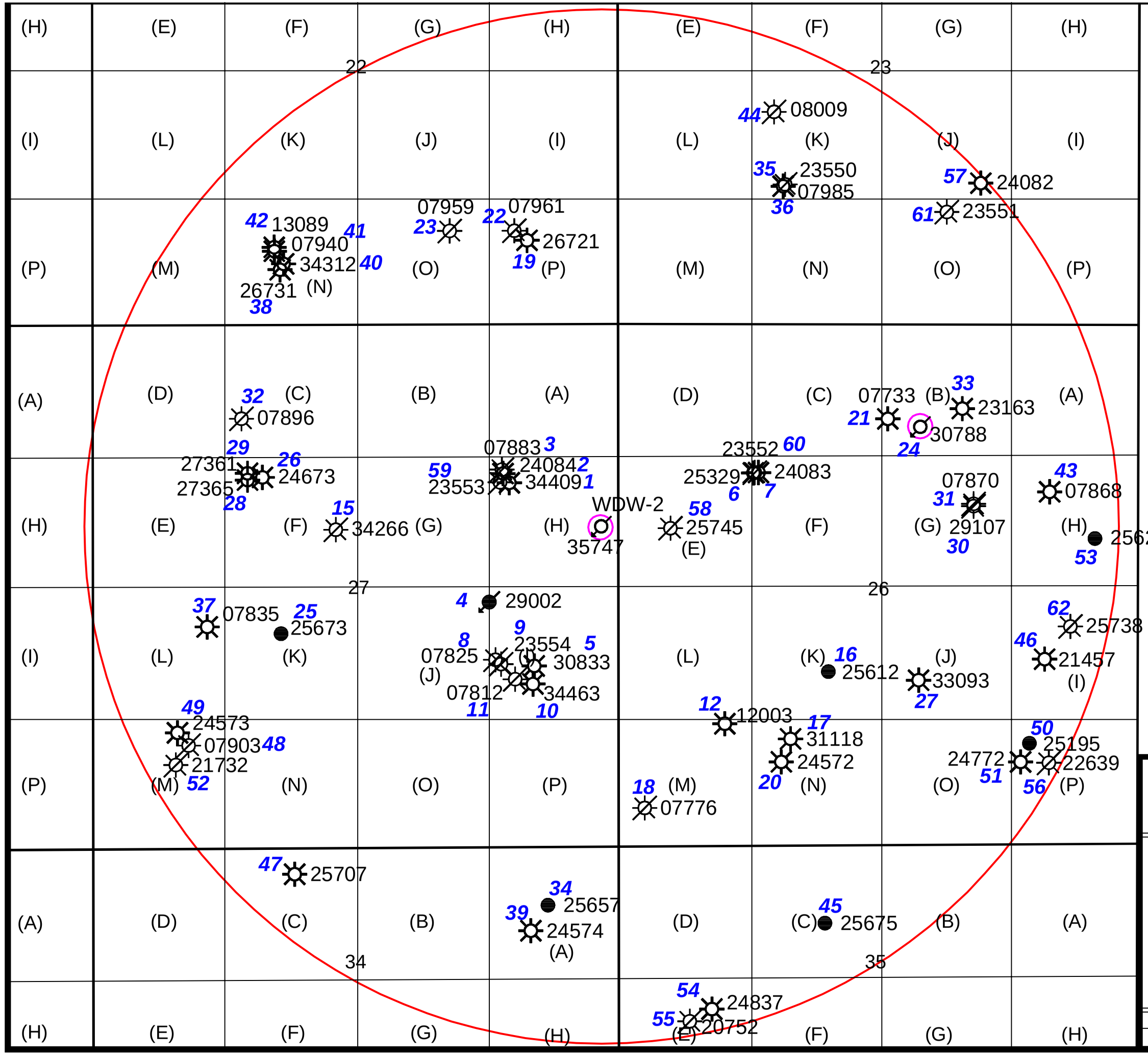
Well/Facility:	SWD #2	Well Status:	Current
Operator:	Western Refinery	Orig Oper:	
Lease/Op Agmt:		Inj Interval:	
Field:	Entrada	API #:	
County:	San Juan	GR/KB:	14.5'
State:	NM	TD:	7525' KB
Spud:	8/15/2016	PBTD:	7490' KB
Comp. Date:		WI:	
1st Prod:		NRI:	
Xmas tree:			
Surface Loc:	2028' fnl & 111' fel		
Sec-Twn-Rge:	Sec 27/T29N/11W		
Comments:	9/7/2017 - Started Injection/Water Disposal Operations		

Date Drawn: October 2016

WALSH ENGINEERING FARMINGTON, NM

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
7309'	Entrada
7470'	Chinle
7525'	TD





WSP USA Inc.
16200 Park Row, Ste 200
Houston TX 77084
TEL: (281) 589-5900

FIGURE 2

WESTERN REFINING SOUTHWEST
BLOOMFIELD, NEW MEXICO

AREA OF REVIEW MAP

DATE: 11/12/2020	CHECKED BY: JT	JOB NO: 192143A
DRAWN BY: WDD	APPROVED BY: JT	DWG NO:

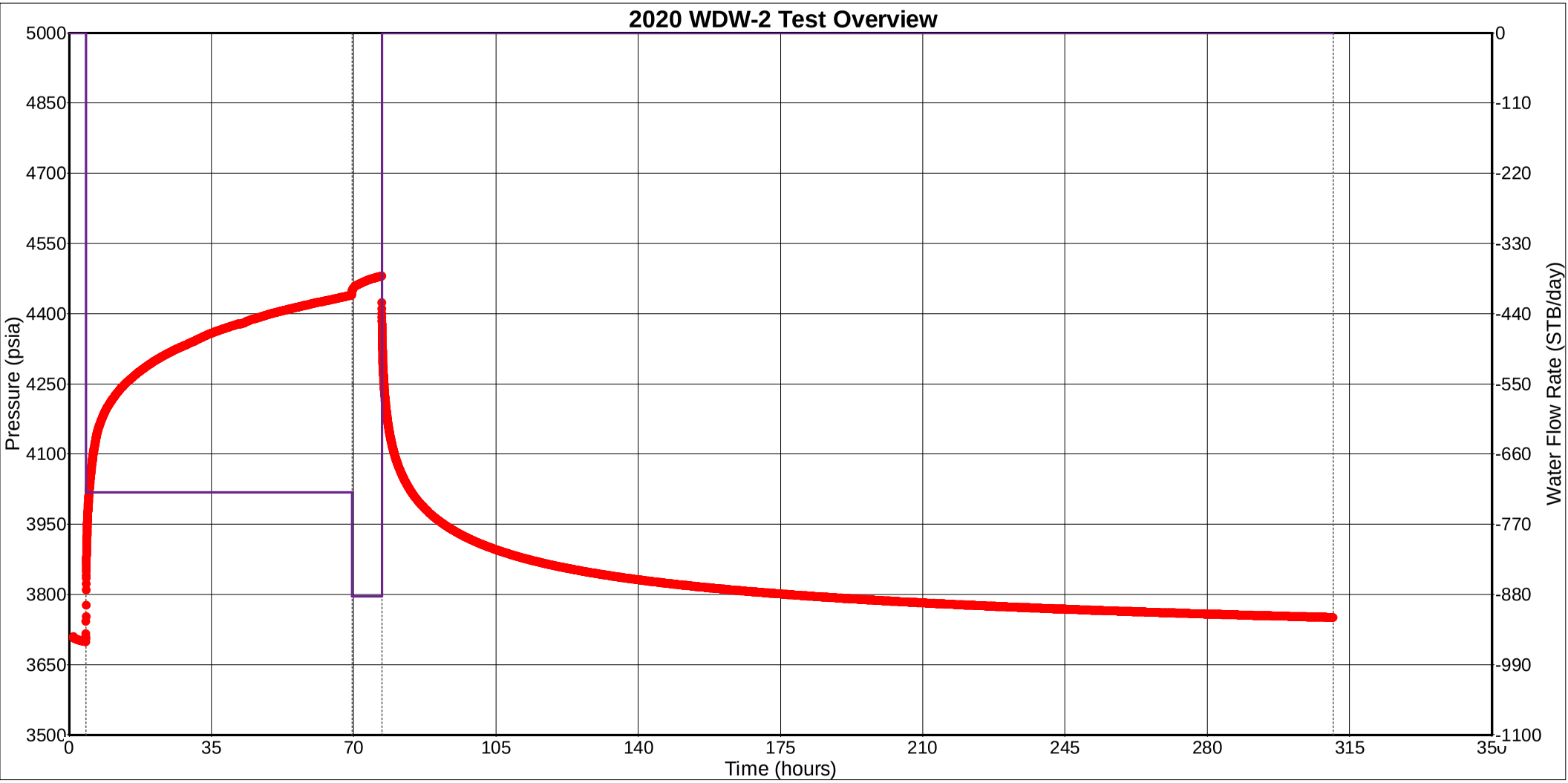

2020 WDW-2 Test Overview
Pressure (psia)
5000
4850
4700
4550
4400
4250
4100
3950
3800
3650
3500
Water Flow Rate (STB/day)
0
-110
-220
-330
-440
-550
-660
-770
-880
-990
-1100
0
35
70
105
140
175
210
245
280
315
350
Time (hours)

FIGURE 3

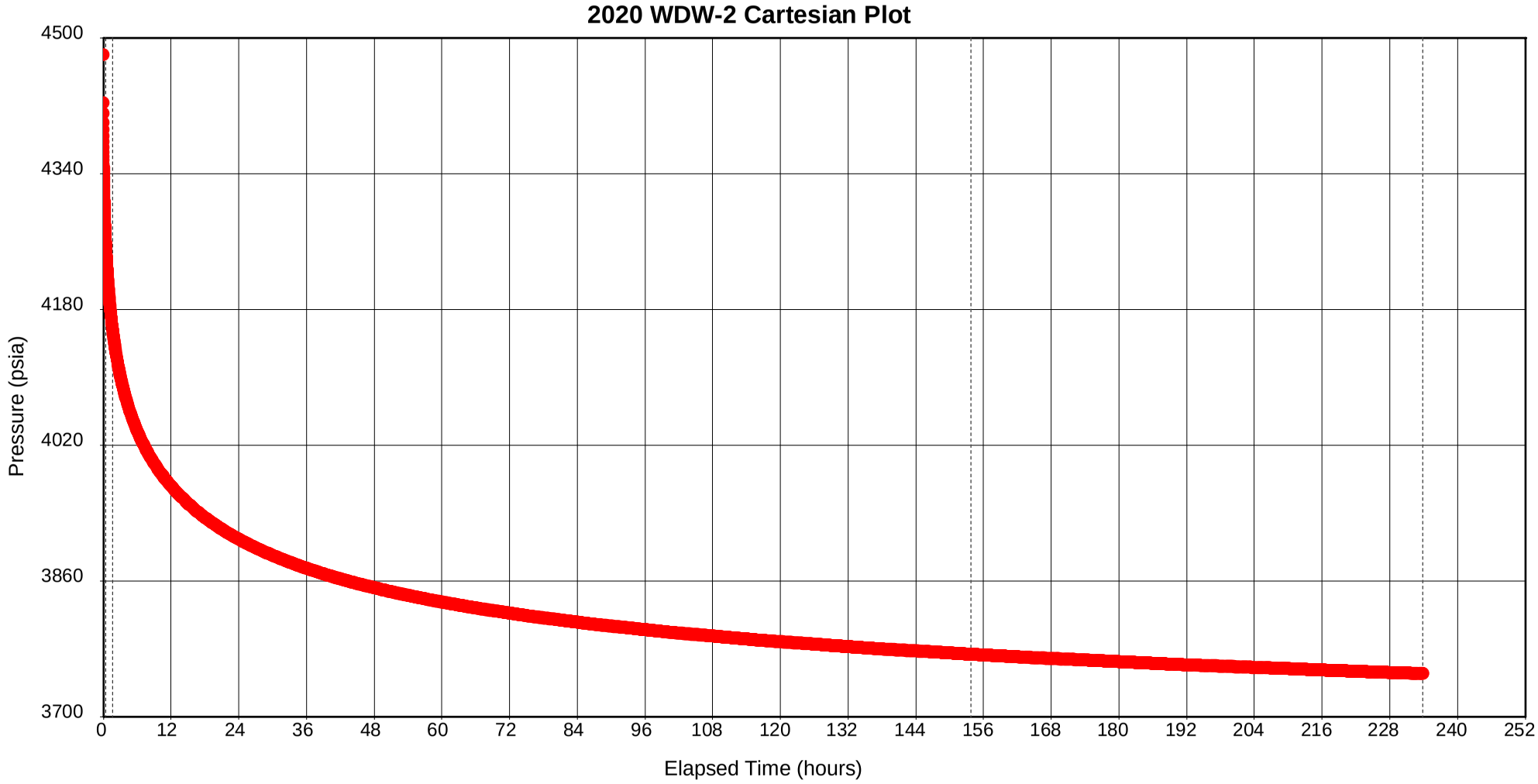

2020 WDW-2 Cartesian Plot
Pressure (psia)
4500
4340
4180
4020
3860
3700
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
240
252
Elapsed Time (hours)

FIGURE 4

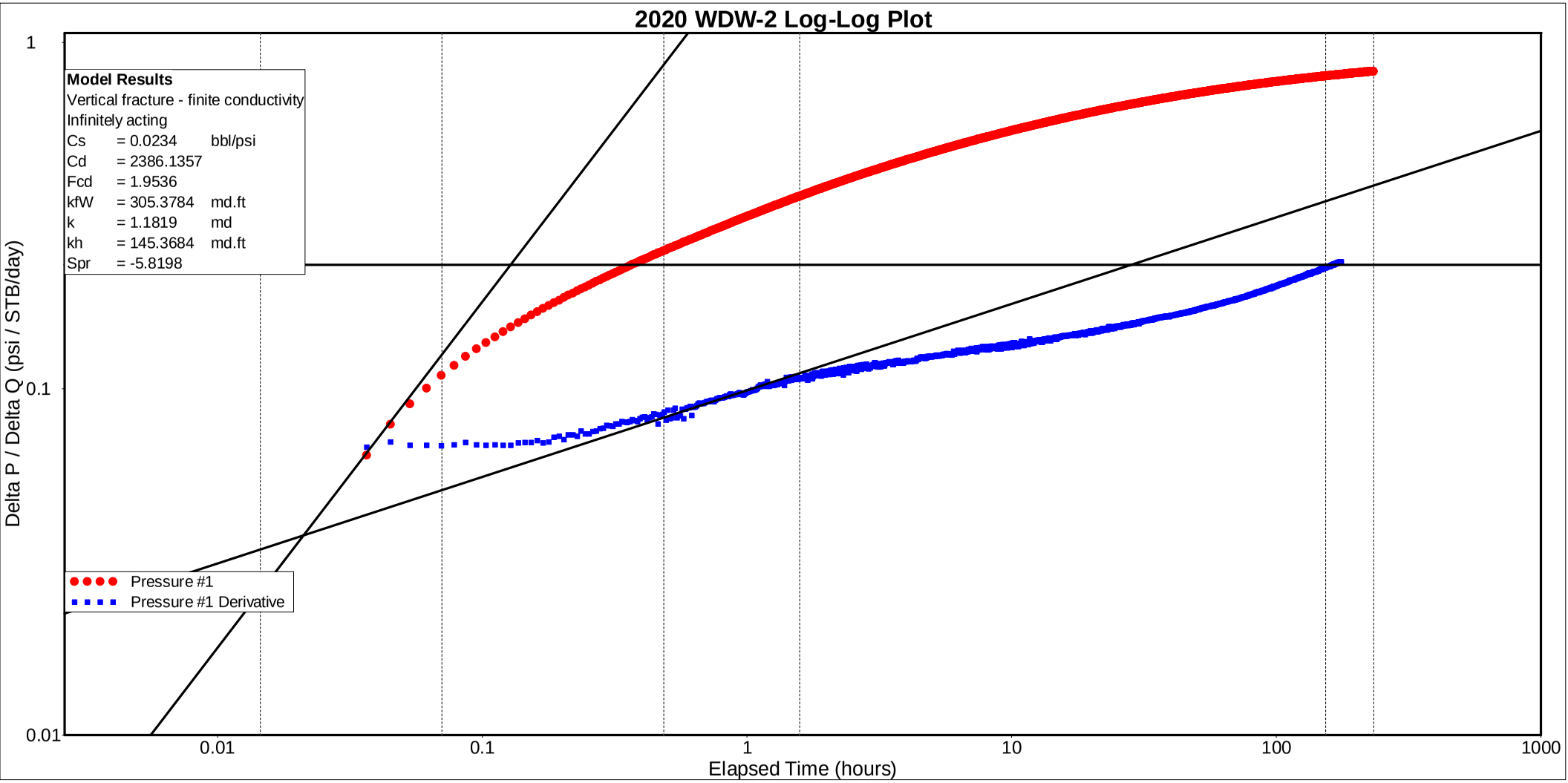

2020 WDW-2 Log-Log Plot
Model Results
Vertical fracture - finite conductivity
Infinitely acting
Cs = 0.0234 bbl/psi
Cd = 2386.1357
Fcd = 1.9536
kfW = 305.3784 md.ft
k = 1.1819 md
kh = 145.3684 md.ft
Spr = -5.8198
Pressure #1
Pressure #1 Derivative
Delta P / Delta Q (psi / STB/day)
1
0.1
0.01
0.01
0.1
1
10
100
1000
Elapsed Time (hours)

FIGURE 5

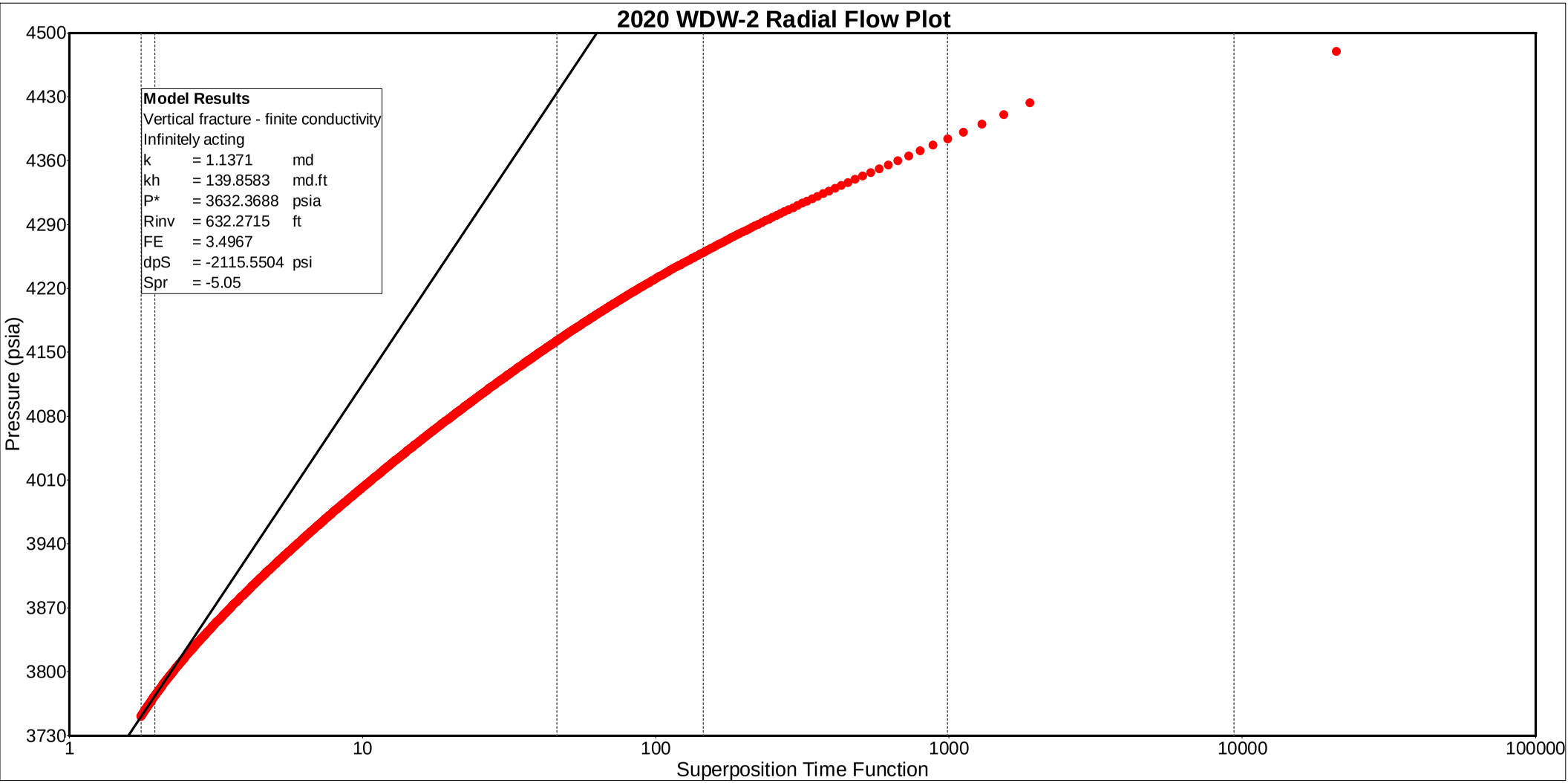

2020 WDW-2 Radial Flow Plot
Model Results
Vertical fracture - finite conductivity
Infinitely acting
k = 1.1371 md
kh = 139.8583 md.ft
P* = 3632.3688 psia
Rinv = 632.2715 ft
FE = 3.4967
dpS = -2115.5504 psi
Spr = -5.05
Pressure (psia)
4500
4430
4360
4290
4220
4150
4080
4010
3940
3870
3800
3730
1
10
100
1000
10000
100000
Superposition Time Function

FIGURE 6

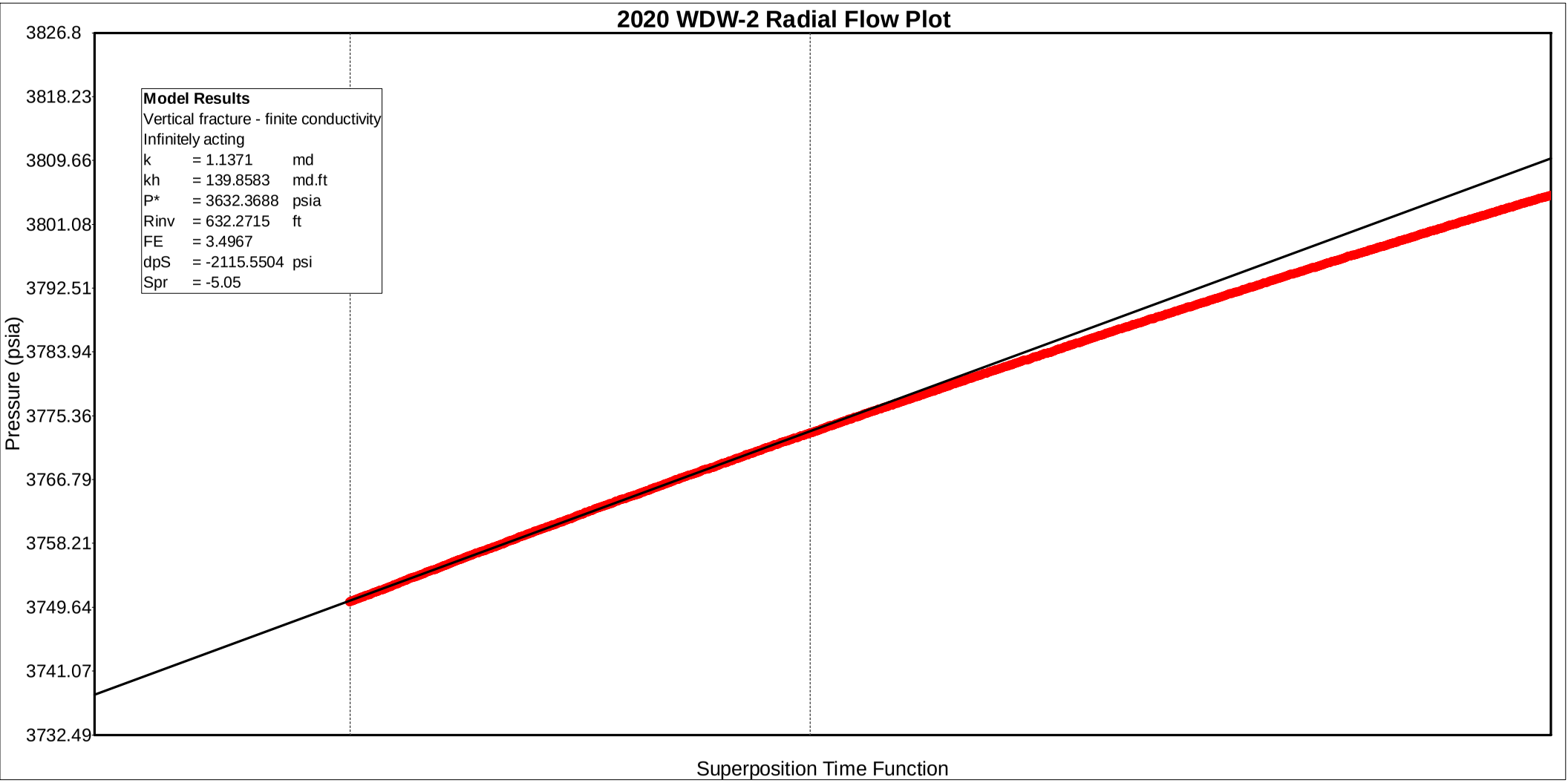

2020 WDW-2 Radial Flow Plot
Model Results
Vertical fracture - finite conductivity
Infinitely acting
k = 1.1371 md
kh = 139.8583 md.ft
P* = 3632.3688 psia
Rinv = 632.2715 ft
FE = 3.4967
dpS = -2115.5504 psi
Spr = -5.05
3826.8
3818.23
3809.66
3801.08
3792.51
3783.94
3775.36
3766.79
3758.21
3749.64
3741.07
3732.49
Pressure (psia)
Superposition Time Function

FIGURE 7

STATIC PRESSURE GRADIENT SURVEY
WASTE DISPOSAL WELL No. 2
OCTOBER 1, 2020

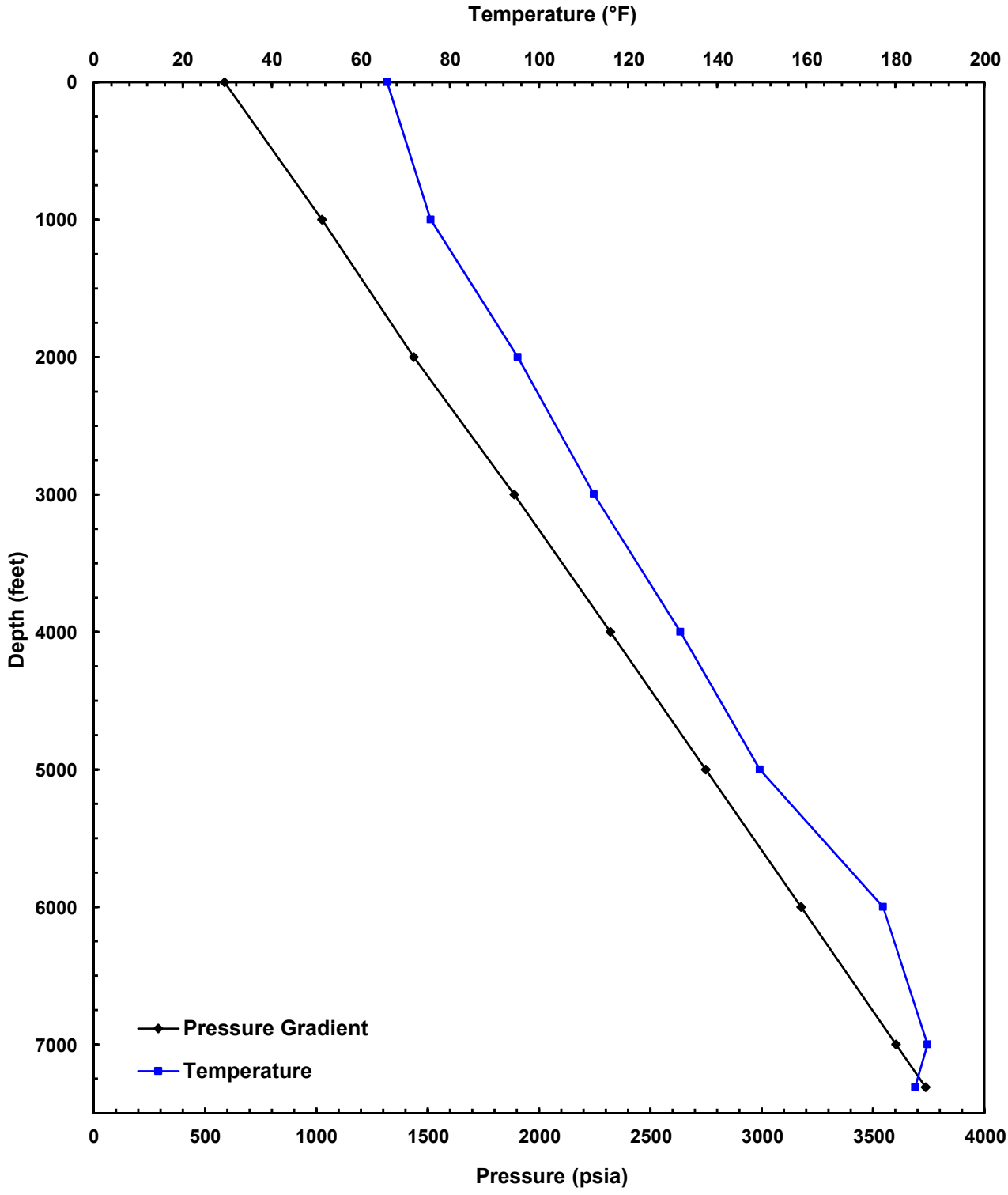


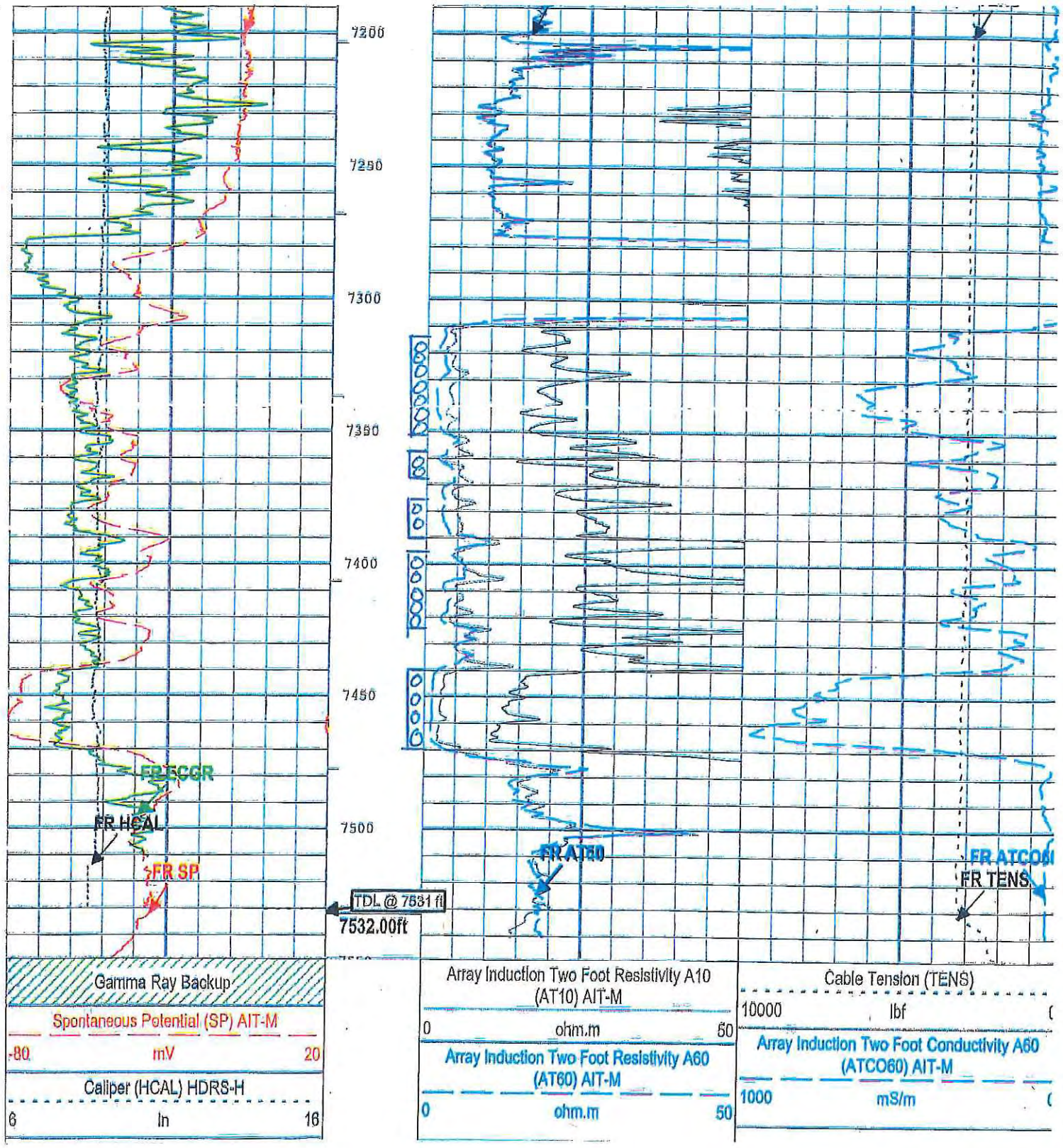
FIGURE 8

APPENDICES

APPENDIX A

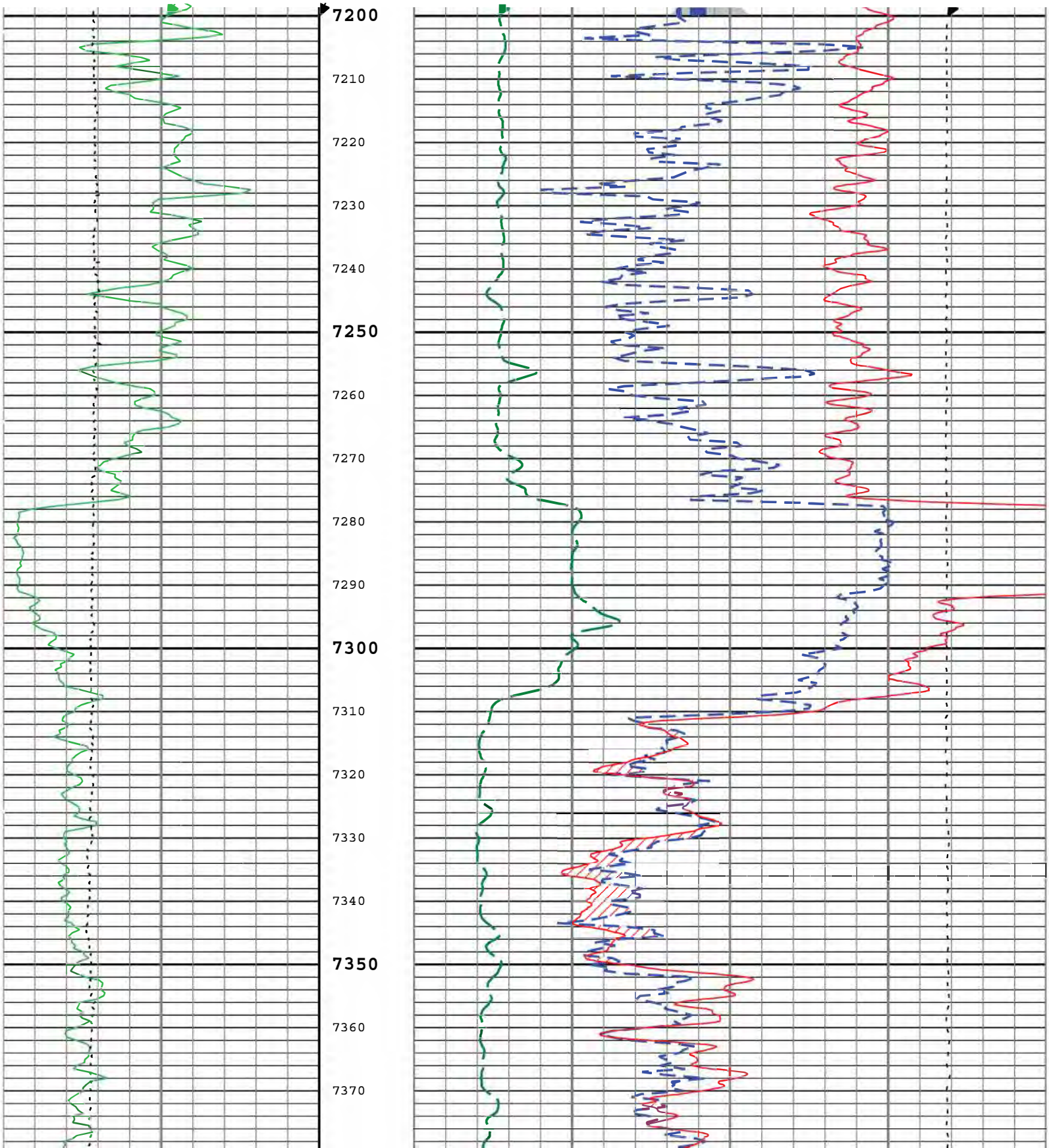
DUAL INDUCTION LOG SECTIONS FROM 7200 FEET TO 7532 FEET

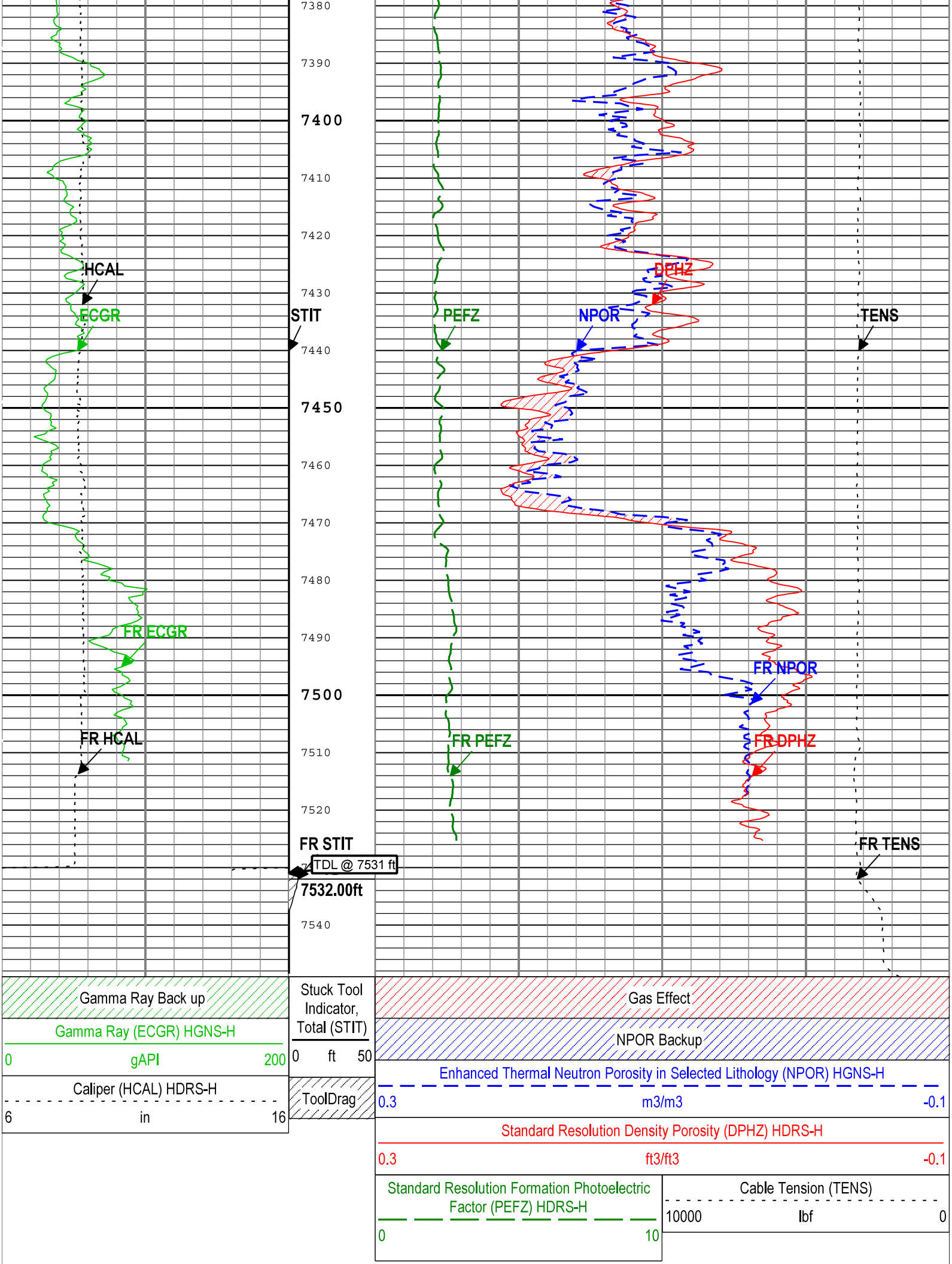
Table 1: A copy of the well log showing the Entrada interval to be tested.



APPENDIX B

POROSITY LOG SECTIONS FROM 7200 FEET TO 7532 FEET


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


7380
7390
7400
7410
7420
7430
7440
7450
7460
7470
7480
7490
7500
7510
7520
7532.00ft
7540
HCAL
ECGR
STIT
PEFZ
NPOR
DPHZ
TENS
FR ECGR
FR HCAL
FR PEFZ
FR NPOR
FR DPHZ
FR STIT
FR TENS
TDL @ 7531 ft
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 C

INJECTION AND FORMATION FLUID ANALYSIS

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

February 01, 2017

Kelly Robinson
Western Refining Southwest, Inc.
#50 CR 4990
Bloomfield, NM 87413
TEL: (505) 632-4135
FAX (505) 632-3911

RE: DWD #2

OrderNo.: 1701A75

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 1/26/2017 for the analyses presented in the following report.

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. In order to properly interpret your results it is imperative that you review this report in its entirety. 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. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

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

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1701A75**
Date Reported: **2/1/2017**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc.
Project: DWD #2
Lab ID: 1701A75-001 **Matrix:** AQUEOUS

Client Sample ID: DWD 2 Formation Water
Collection Date: 1/25/2017 11:00:00 AM
Received Date: 1/26/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **MRA**	
Fluoride	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Chloride	23000	2500	*	mg/L	5E	1/27/2017 7:20:01 PM	R40361
Bromide	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Phosphorus, Orthophosphate (As P)	ND	10		mg/L	20	1/26/2017 6:37:17 PM	R40335
Sulfate	910	25	*	mg/L	50	1/27/2017 7:07:36 PM	R40361
Nitrate+Nitrite as N	ND	20		mg/L	100	1/27/2017 7:32:26 PM	R40361
SM2510B: SPECIFIC CONDUCTANCE						Analyst: **JRR**	
Conductivity	94000	50		µmhos/cm	50	1/30/2017 1:40:54 PM	R40366
SM2320B: ALKALINITY						Analyst: **JRR**	
Bicarbonate (As CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Carbonate (As CaCO3)	ND	2.000		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Total Alkalinity (as CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**	
Total Dissolved Solids	48900	2000	*D	mg/L	1	2/1/2017 3:56:00 PM	29970
EPA 6010B: TOTAL RECOVERABLE METALS						Analyst: **pmf**	
Calcium	1700	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Magnesium	200	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Potassium	450	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Sodium	16000	500		mg/L	500	1/30/2017 11:06:12 AM	29930

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	Value above quantitation range
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
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

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LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Hall Environmental
Project: Not Indicated
Lab ID: B17011690-001
Client Sample ID: 1701A75-001C DWD 2 Formation Water

Report Date: 01/27/17
Collection Date: 01/25/17 11:00
DateReceived: 01/27/17
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
CORROSIVITY							
pH	6.46	s.u.		0.10		SW9040C	01/27/17 10:54 / jmg

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Hall Environmental
Project: Not Indicated

Report Date: 01/27/17
Work Order: B17011690

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW9040C						Analytical Run: ORION 720A HZW_170127A			
Lab ID: ICV	Initial Calibration Verification Standard								01/27/17 10:54
pH	8.11	s.u.	0.10	101	98	102			
Method: SW9040C									Batch: R273874
Lab ID: B17011690-001ADUP	Sample Duplicate				Run: ORION 720A HZW_170127A				01/27/17 10:54
pH	8.49	s.u.	0.10				0.5	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1701A75**

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID **MB**	SampType: **mblk**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R40335**	RunNo: **40335**
Prep Date:	Analysis Date: **1/26/2017**	SeqNo: **1264291** Units: **mg/L**

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

Sample ID **LCSb**	SampType: **lcs**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R40335**	RunNo: **40335**
Prep Date:	Analysis Date: **1/26/2017**	SeqNo: **1264293** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.52	0.10	0.5000	0	104	90	110			
Bromide	2.4	0.10	2.500	0	96.4	90	110			
Phosphorus, Orthophosphate (As P	4.8	0.50	5.000	0	96.7	90	110			

Sample ID **MB**	SampType: **mblk**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R40361**	RunNo: **40361**
Prep Date:	Analysis Date: **1/27/2017**	SeqNo: **1265117** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								
Sulfate	ND	0.50								
Nitrate+Nitrite as N	ND	0.20								

Sample ID **LCS**	SampType: **lcs**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R40361**	RunNo: **40361**
Prep Date:	Analysis Date: **1/27/2017**	SeqNo: **1265118** 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	95.5	90	110			
Sulfate	9.7	0.50	10.00	0	97.2	90	110			
Nitrate+Nitrite as N	3.5	0.20	3.500	0	98.8	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1701A75**

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID **MB-29930**	SampType: **MBLK**	TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **PBW**	Batch ID: **29930**	RunNo: **40375**
Prep Date: **1/27/2017**	Analysis Date: **1/30/2017**	SeqNo: **1265583** 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								
Sodium	ND	1.0								

Sample ID **LCS-29930**	SampType: **LCS**	TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **LCSW**	Batch ID: **29930**	RunNo: **40375**
Prep Date: **1/27/2017**	Analysis Date: **1/30/2017**	SeqNo: **1265584** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	49	1.0	50.00	0	98.3	80	120			
Magnesium	49	1.0	50.00	0	97.3	80	120			
Potassium	47	1.0	50.00	0	94.9	80	120			
Sodium	48	1.0	50.00	0	95.4	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1701A75**

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID **mb-1**	SampType: **mblk**	TestCode: **SM2320B: Alkalinity**
Client ID: **PBW**	Batch ID: **R40366**	RunNo: **40366**
Prep Date:	Analysis Date: **1/30/2017**	SeqNo: **1266120** 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**	SampType: **lcs**	TestCode: **SM2320B: Alkalinity**
Client ID: **LCSW**	Batch ID: **R40366**	RunNo: **40366**
Prep Date:	Analysis Date: **1/30/2017**	SeqNo: **1266121** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low limit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.04	20.00	80.00	0	97.6	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
- R RPD outside accepted recovery limits
- S % Recovery outside of range due to dilution or matrix
- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- P Sample pH Not In Range
- RL Reporting Detection Limit
- W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1701A75**

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID **MB-29970**	SampType: **MBLK**			TestCode: **SM2540C MOD: Total Dissolved Solids**						
Client ID: **PBW**	Batch ID: **29970**			RunNo: **40436**						
Prep Date: **1/31/2017**	Analysis Date: **2/1/2017**			SeqNo: **1267368**		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-29970**	SampType: **LCS**			TestCode: **SM2540C MOD: Total Dissolved Solids**						
Client ID: **LCSW**	Batch ID: **29970**			RunNo: **40436**						
Prep Date: **1/31/2017**	Analysis Date: **2/1/2017**			SeqNo: **1267369**		Units: **mg/L**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

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 Southw Work Order Number: 1701A75 RcptNo: 1

Received by/date: AT 01/26/17

Logged By: Anne Thorne 1/26/2017 7:05:00 AM Anne Thorne

Completed By: Anne Thorne 1/26/2017 9:13:16 AM Anne Thorne

Reviewed By: 1/26/17

Chain of Custody

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

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: 2 (<2 or >12 unless noted)

Adjusted? NO

Checked by: LG

Special Handling (if applicable)

16. 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:

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

Chain-of-Custody Record

Client: Western Refining

Mailing Address: 50 CR 4990
Bloomfield, NM 87413

Phone #: 505-632-4169

email or Fax#:

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

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☐ Standard ☒ Rush 2-day

Project Name:
DWD#2

Project #:
PO-1261903I-2

Project Manager:
Kelly Robinson

Sampler: Matt Kraklow

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.0

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1701A15	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	See attachment				Air Bubbles (Y or N)
1-25-17	11:00	H_2O	DWD2 Formation Water	1-500ml	Poly	001												X				
				1-500ml	HNO_3	001												X				
				1-125ml	H_2SO_4	001												X				

Date:	Time:	Relinquished by:	Received by:	Date	Time
1/25/17	1447			1/25/17	1447
1/25/17	1804			01/26/17	0705

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.

All Anions	EPA Method 300.0	1-500ml unpreserved plastic 1-125 ml H_2SO_4 plastic
Alkalinity	SM2320 B	Volume will come from the 500ml unpreserved plastic
eC	SM 2510B	Volume will come from the 500ml unpreserved plastic
TDS	SM 2540 C	Volume will come from the 500ml unpreserved plastic
Cations	EPA Method 200.7	1-500ml HNO_3 Plastic
pH	EPA Method 9040	Volume will come from the 500ml unpreserved plastic

SM = Standard Methods
EPA Methods 310.1, 150.1, 160.1, 320.1 and 120.1 have been withdrawn by EPA. Most labs ha
We are accredited for all of the tests listed above and we perform these methods regularly for

We will ship out one bottle set today as listed below. Fill all bottles to the neck and keep the sa
We can rush this work on a 1-2 business day TAT.
1-500ml unpreserved plastic
1-125ml H_2SO_4 Plastic
1-500ml HNO_3 plastic

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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

August 17, 2020

Kelly Robinson

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

RE: Injection Well 2 2Q2020 OrderNo.: 2007018

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 7/1/2020 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued July 23, 2020.

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.

Sincerely,

Andy Freeman

Laboratory Manager

4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc. **Client Sample ID:** Injection Well #2
Project: Injection Well 2 2Q2020 **Collection Date:** 6/30/2020
Lab ID: 2007018-001 **Matrix:** AQUEOUS **Received Date:** 7/1/2020 8:05:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8081: PESTICIDES TCLP						Analyst: **JME**	
Chlordane	ND	0.20		mg/L	1	7/15/2020 9:21:46 AM	53534
Surr: Decachlorobiphenyl	75.8	38.2-102		%Rec	1	7/15/2020 9:21:46 AM	53534
Surr: Tetrachloro-m-xylene	52.7	32.3-92.4		%Rec	1	7/15/2020 9:21:46 AM	53534
EPA METHOD 8270C TCLP						Analyst: **DAM**	
2-Methylphenol	ND	200		mg/L	1	7/22/2020 8:27:37 PM	53528
3+4-Methylphenol	ND	200		mg/L	1	7/22/2020 8:27:37 PM	53528
2,4-Dinitrotoluene	ND	0.13		mg/L	1	7/22/2020 8:27:37 PM	53528
Hexachlorobenzene	ND	0.13		mg/L	1	7/22/2020 8:27:37 PM	53528
Hexachlorobutadiene	ND	0.50		mg/L	1	7/22/2020 8:27:37 PM	53528
Hexachloroethane	ND	3.0		mg/L	1	7/22/2020 8:27:37 PM	53528
Nitrobenzene	ND	2.0		mg/L	1	7/22/2020 8:27:37 PM	53528
Pentachlorophenol	ND	100		mg/L	1	7/22/2020 8:27:37 PM	53528
Pyridine	ND	5.0		mg/L	1	7/22/2020 8:27:37 PM	53528
2,4,5-Trichlorophenol	ND	400		mg/L	1	7/22/2020 8:27:37 PM	53528
2,4,6-Trichlorophenol	ND	2.0		mg/L	1	7/22/2020 8:27:37 PM	53528
Cresols, Total	ND	200		mg/L	1	7/22/2020 8:27:37 PM	53528
Surr: 2-Fluorophenol	54.9	15-81.1		%Rec	1	7/22/2020 8:27:37 PM	53528
Surr: Phenol-d5	45.6	15-61.1		%Rec	1	7/22/2020 8:27:37 PM	53528
Surr: 2,4,6-Tribromophenol	77.5	17.2-108		%Rec	1	7/22/2020 8:27:37 PM	53528
Surr: Nitrobenzene-d5	63.0	18.7-120		%Rec	1	7/22/2020 8:27:37 PM	53528
Surr: 2-Fluorobiphenyl	47.7	23.6-103		%Rec	1	7/22/2020 8:27:37 PM	53528
Surr: 4-Terphenyl-d14	94.9	24.1-105		%Rec	1	7/22/2020 8:27:37 PM	53528
SPECIFIC GRAVITY						Analyst: **CAS**	
Specific Gravity	0.9946	0			1	7/1/2020 2:10:00 PM	R70056
EPA METHOD 300.0: ANIONS						Analyst: **CAS**	
Fluoride	ND	0.50		mg/L	5	7/1/2020 10:01:06 PM	R70074
Chloride	1200	50	*	mg/L	100	7/2/2020 4:39:21 PM	R70134
Nitrogen, Nitrite (As N)	ND	0.50		mg/L	5	7/1/2020 10:01:06 PM	R70074
Bromide	4.0	0.50		mg/L	5	7/1/2020 10:01:06 PM	R70074
Nitrogen, Nitrate (As N)	ND	0.50		mg/L	5	7/1/2020 10:01:06 PM	R70074
Phosphorus, Orthophosphate (As P)	ND	2.5		mg/L	5	7/1/2020 10:01:06 PM	R70074
Sulfate	78	2.5		mg/L	5	7/1/2020 10:01:06 PM	R70074
SM2510B: SPECIFIC CONDUCTANCE						Analyst: **JRR**	
Conductivity	4500	10		µmhos/c	1	7/7/2020 10:26:38 AM	R70195
SM2320B: ALKALINITY						Analyst: **JRR**	
Bicarbonate (As CaCO3)	647.1	20.00		mg/L Ca	1	7/7/2020 10:26:38 AM	R70195
Carbonate (As CaCO3)	ND	2.000		mg/L Ca	1	7/7/2020 10:26:38 AM	R70195

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	Value above quantitation range
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 range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc. **Client Sample ID:** Injection Well #2
Project: Injection Well 2 2Q2020 **Collection Date:** 6/30/2020
Lab ID: 2007018-001 **Matrix:** AQUEOUS **Received Date:** 7/1/2020 8:05:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
SM2320B: ALKALINITY						Analyst: **JRR**	
Total Alkalinity (as CaCO3)	647.1	20.00		mg/L Ca	1	7/7/2020 10:26:38 AM	R70195
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**	
Total Dissolved Solids	2870	200	*D	mg/L	1	7/8/2020 10:16:00 AM	53514
SM4500-H+B / 9040C: PH						Analyst: **JRR**	
pH	7.77		H	pH units	1	7/7/2020 10:26:38 AM	R70195
EPA METHOD 7470: MERCURY						Analyst: **JLF**	
Mercury	ND	0.0010		mg/L	5	7/7/2020 4:27:56 PM	53531
EPA 6010B: TOTAL RECOVERABLE METALS						Analyst: **ELS**	
Arsenic	ND	0.030		mg/L	1	7/8/2020 12:41:36 PM	53551
Barium	0.22	0.0020		mg/L	1	7/8/2020 12:41:36 PM	53551
Cadmium	ND	0.0020		mg/L	1	7/8/2020 12:41:36 PM	53551
Calcium	73	1.0		mg/L	1	7/8/2020 12:41:36 PM	53551
Chromium	ND	0.0060		mg/L	1	7/8/2020 12:41:36 PM	53551
Lead	ND	0.020		mg/L	1	7/8/2020 12:41:36 PM	53551
Magnesium	52	1.0		mg/L	1	7/8/2020 12:41:36 PM	53551
Potassium	13	1.0		mg/L	1	7/8/2020 12:41:36 PM	53551
Selenium	ND	0.050		mg/L	1	7/8/2020 12:41:36 PM	53551
Silver	ND	0.0050		mg/L	1	7/8/2020 12:41:36 PM	53551
Sodium	910	10		mg/L	10	7/8/2020 1:06:08 PM	53551
TCLP VOLATILES BY 8260B						Analyst: **CCM**	
Benzene	ND	0.50		mg/L	200	7/7/2020 12:55:00 AM	T70113
1,2-Dichloroethane (EDC)	ND	0.50		mg/L	200	7/7/2020 12:55:00 AM	T70113
2-Butanone	ND	200		mg/L	200	7/7/2020 12:55:00 AM	T70113
Carbon Tetrachloride	ND	0.50		mg/L	200	7/7/2020 12:55:00 AM	T70113
Chloroform	ND	6.0		mg/L	200	7/7/2020 12:55:00 AM	T70113
1,4-Dichlorobenzene	ND	7.5		mg/L	200	7/7/2020 12:55:00 AM	T70113
1,1-Dichloroethene	ND	0.70		mg/L	200	7/7/2020 12:55:00 AM	T70113
Tetrachloroethene (PCE)	ND	0.70		mg/L	200	7/7/2020 12:55:00 AM	T70113
Trichloroethene (TCE)	ND	0.50		mg/L	200	7/7/2020 12:55:00 AM	T70113
Vinyl chloride	ND	0.20		mg/L	200	7/7/2020 12:55:00 AM	T70113
Chlorobenzene	ND	100		mg/L	200	7/7/2020 12:55:00 AM	T70113
Surr: 1,2-Dichloroethane-d4	103	70-130		%Rec	200	7/7/2020 12:55:00 AM	T70113
Surr: 4-Bromofluorobenzene	102	70-130		%Rec	200	7/7/2020 12:55:00 AM	T70113
Surr: Dibromofluoromethane	106	70-130		%Rec	200	7/7/2020 12:55:00 AM	T70113
Surr: Toluene-d8	102	70-130		%Rec	200	7/7/2020 12:55:00 AM	T70113

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	Value above quantitation range
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 range due to dilution or matrix		

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

July 14, 2020

Hall Environmental Analysis Laboratory

Sample Delivery Group:	L1236077
Samples Received:	07/02/2020
Project Number:	
Description:	

Report To: Jackie Bolte
4901 Hawkins NE
Albuquerque, NM 87109

Entire Report Reviewed By:

John Hawkins
Project Manager

TABLE OF CONTENTS

2007018-001E INJECTION WELL #2 L1236077-01 WW

Collected by	Collected date/time	Received date/time
	06/30/20 00:00	07/02/20 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2580	WG1504658	1	07/07/20 05:39	07/07/20 05:39	AKA	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG1503689	1	07/03/20 12:57	07/03/20 12:57	KEG	Mt. Juliet, TN
Wet Chemistry by Method D93/1010A	WG1506806	1	07/11/20 19:15	07/11/20 19:15	JIC	Mt. Juliet, TN

2007018-001F INJECTION WELL #2 L1236077-02 WW

Collected by	Collected date/time	Received date/time
	06/30/20 00:00	07/02/20 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 9034-9030B	WG1504791	1	07/07/20 15:23	07/07/20 15:23	SL	Mt. Juliet, TN

2007018-001G INJECTION WELL #2 L1236077-03 WW

Collected by	Collected date/time	Received date/time
	06/30/20 00:00	07/02/20 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 4500 CN E-2011	WG1507316	1	07/11/20 18:08	07/13/20 15:06	JER	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John Hawkins
Project Manager

Project Narrative

All Reactive Cyanide results reported in the attached report were determined as totals using method 9012B.
All Reactive Sulfide results reported in the attached report were determined as totals using method 9034/9030B.

Wet Chemistry by Method 2580

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	mV			date / time	
ORP	37.7	Q	1	07/07/2020 05:39	WG1504658

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
Corrosivity by pH	7.63	T8	1	07/03/2020 12:57	WG1503689

Sample Narrative:

L1236077-01 WG1503689: 7.63 at 21.1C

Wet Chemistry by Method D93/1010A

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	deg F			date / time	
Flashpoint	DNF at 170		1	07/11/2020 19:15	WG1506806

Wet Chemistry by Method 9034-9030B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Sulfide	0.833		0.0500	1	07/07/2020 15:23	WG1504791

Wet Chemistry by Method 4500 CN E-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Cyanide	ND		0.00500	1	07/13/2020 15:06	WG1507316

L1236077-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1236077-01 07/07/20 05:39 • (DUP) R3546691-2 07/07/20 05:39

Analyte	Original Result	DUP Result	Dilution	DUP Diff	DUP Qualifier	DUP Diff Limits
	mV	mV		mV		mV
ORP	37.7	55.8	1	18.1		20

Laboratory Control Sample (LCS)

(LCS) R3546691-1 07/07/20 05:39

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	mV	mV	%	%	
ORP	228	226	99.0	86.0-105	

Method Blank (MB)

(MB) R3548947-1 07/13/20 14:32

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Reactive Cyanide	U		0.00180	0.00500

Original Sample (OS) • Duplicate (DUP)

(OS) • (DUP) R3548947-3 07/13/20 14:37

Analyte	Original Result	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Reactive Cyanide		ND	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3548947-2 07/13/20 14:33

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Reactive Cyanide	0.100	0.0984	98.4	90.0-110	

Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) • (MS) R3548947-4 07/13/20 15:04 • (MSD) R3548947-5 07/13/20 15:05

Analyte	Spike Amount mg/l	Original Result	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Reactive Cyanide	0.100		0.106	0.101	106	101	1	75.0-125			4.83	20

Laboratory Control Sample (LCS)

(LCS) R3545989-1 07/03/20 12:57

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
Corrosivity by pH	10.0	10.1	101	99.0-101	

Sample Narrative:

LCS: 10.05 at 22.2C

Method Blank (MB)

(MB) R3547698-1 07/07/20 14:56

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Reactive Sulfide	U		0.00650	0.0500

Laboratory Control Sample (LCS)

(LCS) R3547698-2 07/07/20 14:56

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Reactive Sulfide	0.500	0.473	94.6	85.0-115	

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3548542-1 07/11/20 19:15 • (LCSD) R3548542-2 07/11/20 19:15

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	deg F	deg F	deg F	%	%	%			%	%
Flashpoint	126	127	125	101	99.1	96.0-104			1.59	10

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
T8	Sample(s) received past/too close to holding time expiration.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

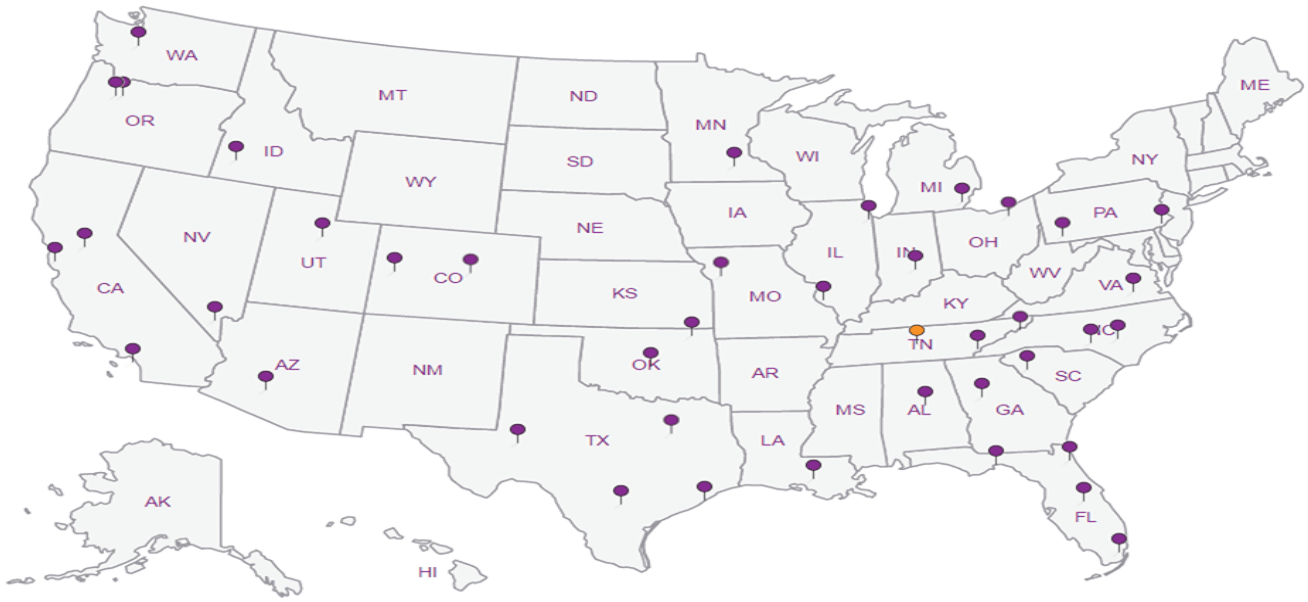
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

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

SUB CONTRATOR:	Pace TN	COMPANY: PACE TN	PHONE: (800) 767-5859	FAX: (615) 758-5859	
ADDRESS:	12065 Lebanon Rd		ACCOUNT #:	EMAIL:	
CITY, STATE, ZIP:	Mt. Juliet, TN 37122				

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2007018-001E	Injection Well #2	500HDPE	Aqueous	6/30/2020	1	ORP, Corrosivity, Ignitability L1236077-01
2	2007018-001F	Injection Well #2	500PLNAOH ZNAC	Aqueous	6/30/2020	1	Reactive Sulfide 02
3	2007018-001G	Injection Well #2	500PL-NaOH	Aqueous	6/30/2020	1	Reactive Cyanide 03

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: EM	Date: 7/1/2020	Time: 11:19 AM	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By: Jacorso	Date: 7/2/20	Time: 8:45

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 5.1+0.5 °C AT Attempt to Cool ? _____
Comments: _____ (02)

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **MB**	SampType: **mblk**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R70074**	RunNo: **70074**
Prep Date:	Analysis Date: **7/1/2020**	SeqNo: **2434415** 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: **R70074**	RunNo: **70074**
Prep Date:	Analysis Date: **7/1/2020**	SeqNo: **2434416** 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	108	90	110			
Nitrogen, Nitrite (As N)	0.98	0.10	1.000	0	98.3	90	110			
Bromide	2.5	0.10	2.500	0	101	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	100	90	110			
Phosphorus, Orthophosphate (As P	4.7	0.50	5.000	0	94.3	90	110			
Sulfate	9.8	0.50	10.00	0	98.0	90	110			

Sample ID: **MB**	SampType: **mblk**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R70134**	RunNo: **70134**
Prep Date:	Analysis Date: **7/2/2020**	SeqNo: **2437168** 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: **R70134**	RunNo: **70134**
Prep Date:	Analysis Date: **7/2/2020**	SeqNo: **2437169** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.9	0.50	5.000	0	98.4	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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **MB-53534** SampType: **MBLK** TestCode: **EPA Method 8081: Pesticides TCLP**

Client ID: **PBW** Batch ID: **53534** RunNo: **70353**

Prep Date: **7/7/2020** Analysis Date: **7/15/2020** SeqNo: **2445441** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chlordane	ND	0.030								
Surr: Decachlorobiphenyl	0.0022		0.002500		87.3	38.2	102			
Surr: Tetrachloro-m-xylene	0.0018		0.002500		72.0	32.3	92.4			

Sample ID: **LCS-53534** SampType: **LCS** TestCode: **EPA Method 8081: Pesticides TCLP**

Client ID: **LCSW** Batch ID: **53534** RunNo: **70353**

Prep Date: **7/7/2020** Analysis Date: **7/15/2020** SeqNo: **2445442** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	0.0022		0.002500		88.4	38.2	102			
Surr: Tetrachloro-m-xylene	0.0019		0.002500		77.1	32.3	92.4			

Sample ID: **LCSD-53534** SampType: **LCSD** TestCode: **EPA Method 8081: Pesticides TCLP**

Client ID: **LCSS02** Batch ID: **53534** RunNo: **70353**

Prep Date: **7/7/2020** Analysis Date: **7/15/2020** SeqNo: **2445443** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	0.0024		0.002500		96.2	38.2	102	0	0	
Surr: Tetrachloro-m-xylene	0.0017		0.002500		66.1	32.3	92.4	0	0	

Sample ID: **MB-53534** SampType: **MBLK** TestCode: **EPA Method 8081: Pesticides TCLP**

Client ID: **PBW** Batch ID: **53534** RunNo: **70353**

Prep Date: **7/7/2020** Analysis Date: **7/15/2020** SeqNo: **2445445** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chlordane	ND	0.030								
Surr: Decachlorobiphenyl	0.0022		0.002500		86.5	38.2	102			
Surr: Tetrachloro-m-xylene	0.0018		0.002500		72.9	32.3	92.4			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **100ng lcs** SampType: **LCS** TestCode: **TCLP Volatiles by 8260B**

Client ID: **LCSW** Batch ID: **T70113** RunNo: **70113**

Prep Date: Analysis Date: **7/6/2020** SeqNo: **2438829** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.019	0.00023	0.02000	0	95.7	70	130			
1,1-Dichloroethene	0.019	0.00013	0.02000	0	95.1	70	130			
Trichloroethene (TCE)	0.018	0.00020	0.02000	0	88.0	70	130			
Chlorobenzene	0.021	0.00014	0.02000	0	107	70	130			
Surr: 1,2-Dichloroethane-d4	0.0098		0.01000		98.0	70	130			
Surr: 4-Bromofluorobenzene	0.010		0.01000		102	70	130			
Surr: Dibromofluoromethane	0.0096		0.01000		96.4	70	130			
Surr: Toluene-d8	0.010		0.01000		102	70	130			

Sample ID: **MB** SampType: **MBLK** TestCode: **TCLP Volatiles by 8260B**

Client ID: **PBW** Batch ID: **T70113** RunNo: **70113**

Prep Date: Analysis Date: **7/6/2020** SeqNo: **2438830** 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		102	70	130			
Surr: 4-Bromofluorobenzene	0.010		0.01000		100	70	130			
Surr: Dibromofluoromethane	0.010		0.01000		99.5	70	130			
Surr: Toluene-d8	0.010		0.01000		100	70	130			

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **mb-53528** SampType: **MBLK** TestCode: **EPA Method 8270C TCLP**

Client ID: **PBW** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453803** 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								
2,4,5-Trichlorophenol	ND	400								
2,4,6-Trichlorophenol	ND	2.0								
Cresols, Total	ND	200								
Surr: 2-Fluorophenol	0.13		0.2000		67.3	15	81.1			
Surr: Phenol-d5	0.10		0.2000		52.1	15	61.1			
Surr: 2,4,6-Tribromophenol	0.15		0.2000		74.1	17.2	108			
Surr: Nitrobenzene-d5	0.078		0.1000		77.9	18.7	120			
Surr: 2-Fluorobiphenyl	0.059		0.1000		59.0	23.6	103			
Surr: 4-Terphenyl-d14	0.11		0.1000		114	24.1	105			S

Sample ID: **lcs-53528** SampType: **LCS** TestCode: **EPA Method 8270C TCLP**

Client ID: **LCSW** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453804** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.077	0.0010	0.1000	0	76.5	33.8	121			
3+4-Methylphenol	0.16	0.0010	0.2000	0	81.8	33.6	109			
2,4-Dinitrotoluene	0.055	0.0010	0.1000	0	54.8	50.4	124			
Hexachlorobenzene	0.088	0.0010	0.1000	0	88.1	50.1	120			
Hexachlorobutadiene	0.043	0.0010	0.1000	0	42.5	16.1	103			
Hexachloroethane	0.042	0.0010	0.1000	0	42.3	15	94.2			
Nitrobenzene	0.087	0.0010	0.1000	0	87.4	32.4	125			
Pentachlorophenol	0.080	0.0010	0.1000	0	79.7	44.6	114			
Pyridine	0.011	0.0010	0.1000	0	11.2	15	67			S
2,4,5-Trichlorophenol	0.082	0.0010	0.1000	0	81.9	49.4	118			
2,4,6-Trichlorophenol	0.083	0.0010	0.1000	0	82.6	50.3	116			
Cresols, Total	0.24	0.0010	0.3000	0	80.0	33.8	109			
Surr: 2-Fluorophenol	0.12		0.2000		61.5	15	81.1			
Surr: Phenol-d5	0.092		0.2000		45.8	15	61.1			
Surr: 2,4,6-Tribromophenol	0.14		0.2000		72.4	17.2	108			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **lcs-53528** SampType: **LCS** TestCode: **EPA Method 8270C TCLP**

Client ID: **LCSW** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453804** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Nitrobenzene-d5	0.080		0.1000		80.5	18.7	120			
Surr: 2-Fluorobiphenyl	0.060		0.1000		59.6	23.6	103			
Surr: 4-Terphenyl-d14	0.11		0.1000		108	24.1	105			S

Sample ID: **2007018-001bms** SampType: **MS** TestCode: **EPA Method 8270C TCLP**

Client ID: **Injection Well #2** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453806** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.095	0.0010	0.1000	0	95.3	30.5	98.2			
3+4-Methylphenol	0.21	0.0010	0.2000	0	106	27.4	98.6			S
2,4-Dinitrotoluene	0.077	0.0010	0.1000	0	77.0	34.3	87.4			
Hexachlorobenzene	0.094	0.0010	0.1000	0	93.8	36.5	100			
Hexachlorobutadiene	0.053	0.0010	0.1000	0	52.9	15	108			
Hexachloroethane	0.054	0.0010	0.1000	0	53.6	15	90.7			
Nitrobenzene	0.095	0.0010	0.1000	0	95.4	39	100			
Pentachlorophenol	0.088	0.0010	0.1000	0	87.5	15	97.5			
Pyridine	0.010	0.0010	0.1000	0	10.4	15	65.8			S
2,4,5-Trichlorophenol	0.091	0.0010	0.1000	0	90.7	36.1	109			
2,4,6-Trichlorophenol	0.095	0.0010	0.1000	0	94.9	37.8	104			
Cresols, Total	0.31	0.0010	0.3000	0	102	27.1	99.8			S
Surr: 2-Fluorophenol	0.15		0.2000		72.6	15	81.1			
Surr: Phenol-d5	0.11		0.2000		54.5	15	61.1			
Surr: 2,4,6-Tribromophenol	0.17		0.2000		86.3	17.2	108			
Surr: Nitrobenzene-d5	0.091		0.1000		91.2	18.7	120			
Surr: 2-Fluorobiphenyl	0.070		0.1000		69.8	23.6	103			
Surr: 4-Terphenyl-d14	0.10		0.1000		102	24.1	105			

Sample ID: **2007018-001bmsd** SampType: **MSD** TestCode: **EPA Method 8270C TCLP**

Client ID: **Injection Well #2** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453807** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.076	0.0010	0.1000	0	75.9	30.5	98.2	22.7	44.3	
3+4-Methylphenol	0.16	0.0010	0.2000	0	79.5	27.4	98.6	28.3	50	
2,4-Dinitrotoluene	0.067	0.0010	0.1000	0	67.0	34.3	87.4	13.9	45.1	
Hexachlorobenzene	0.082	0.0010	0.1000	0	81.9	36.5	100	13.6	47.2	
Hexachlorobutadiene	0.039	0.0010	0.1000	0	39.3	15	108	29.4	43.4	
Hexachloroethane	0.039	0.0010	0.1000	0	38.9	15	90.7	31.8	39.2	
Nitrobenzene	0.077	0.0010	0.1000	0	76.6	39	100	21.9	42.1	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **2007018-001bmsd** SampType: **MSD** TestCode: **EPA Method 8270C TCLP**

Client ID: **Injection Well #2** Batch ID: **53528** RunNo: **70542**

Prep Date: **7/7/2020** Analysis Date: **7/22/2020** SeqNo: **2453807** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Pentachlorophenol	0.086	0.0010	0.1000	0	85.6	15	97.5	2.30	50	
Pyridine	ND	0.0010	0.1000	0	0.0392	15	65.8	200	50	RS
2,4,5-Trichlorophenol	0.086	0.0010	0.1000	0	85.6	36.1	109	5.85	49.7	
2,4,6-Trichlorophenol	0.080	0.0010	0.1000	0	80.2	37.8	104	16.8	47	
Cresols, Total	0.23	0.0010	0.3000	0	78.3	27.1	99.8	26.5	27.4	
Surr: 2-Fluorophenol	0.13		0.2000		62.9	15	81.1	0	0	
Surr: Phenol-d5	0.10		0.2000		50.9	15	61.1	0	0	
Surr: 2,4,6-Tribromophenol	0.16		0.2000		81.5	17.2	108	0	0	
Surr: Nitrobenzene-d5	0.079		0.1000		79.4	18.7	120	0	0	
Surr: 2-Fluorobiphenyl	0.060		0.1000		59.7	23.6	103	0	0	
Surr: 4-Terphenyl-d14	0.10		0.1000		104	24.1	105	0	0	

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **lcs-1 99.5uS eC**	SampType: **lcs**		TestCode: **SM2510B: Specific Conductance**		
Client ID: **LCSW**	Batch ID: **R70195**		RunNo: **70195**		
Prep Date:	Analysis Date: **7/7/2020**		SeqNo: **2439134**	Units: **µmhos/cm**	

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	99	10	99.50	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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **MB-53531** SampType: **MBLK** TestCode: **EPA Method 7470: Mercury**

Client ID: **PBW** Batch ID: **53531** RunNo: **70152**

Prep Date: **7/7/2020** Analysis Date: **7/7/2020** SeqNo: **2437876** Units: **mg/L**

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

Sample ID: **LLLCS-53531** SampType: **LCSLL** TestCode: **EPA Method 7470: Mercury**

Client ID: **BatchQC** Batch ID: **53531** RunNo: **70152**

Prep Date: **7/7/2020** Analysis Date: **7/7/2020** SeqNo: **2437877** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020	0.0001500	0	96.1	50	150			

Sample ID: **LCS-53531** SampType: **LCS** TestCode: **EPA Method 7470: Mercury**

Client ID: **LCSW** Batch ID: **53531** RunNo: **70152**

Prep Date: **7/7/2020** Analysis Date: **7/7/2020** SeqNo: **2437878** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	98.2	80	120			

Sample ID: **2007018-001DMS** SampType: **MS** TestCode: **EPA Method 7470: Mercury**

Client ID: **Injection Well #2** Batch ID: **53531** RunNo: **70152**

Prep Date: **7/7/2020** Analysis Date: **7/7/2020** SeqNo: **2437885** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0025	0.0010	0.005000	0	49.4	75	125			S

Sample ID: **2007018-001DMSD** SampType: **MSD** TestCode: **EPA Method 7470: Mercury**

Client ID: **Injection Well #2** Batch ID: **53531** RunNo: **70152**

Prep Date: **7/7/2020** Analysis Date: **7/7/2020** SeqNo: **2437886** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0024	0.0010	0.005000	0	48.5	75	125	1.89	20	S

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **MB-53551** SampType: **MBLK** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **PBW** Batch ID: **53551** RunNo: **70197**

Prep Date: **7/7/2020** Analysis Date: **7/8/2020** SeqNo: **2439313** 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								
Calcium	ND	1.0								
Chromium	ND	0.0060								
Lead	ND	0.020								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Selenium	ND	0.050								
Silver	ND	0.0050								
Sodium	ND	1.0								

Sample ID: **LCS-53551** SampType: **LCS** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **LCSW** Batch ID: **53551** RunNo: **70197**

Prep Date: **7/7/2020** Analysis Date: **7/8/2020** SeqNo: **2439314** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.45	0.030	0.5000	0	89.1	80	120			
Barium	0.47	0.0020	0.5000	0	93.1	80	120			
Cadmium	0.46	0.0020	0.5000	0	92.8	80	120			
Calcium	51	1.0	50.00	0	102	80	120			
Chromium	0.45	0.0060	0.5000	0	89.1	80	120			
Lead	0.45	0.020	0.5000	0	90.6	80	120			
Magnesium	51	1.0	50.00	0	103	80	120			
Potassium	50	1.0	50.00	0	99.2	80	120			
Selenium	0.45	0.050	0.5000	0	90.1	80	120			
Silver	0.095	0.0050	0.1000	0	95.0	80	120			
Sodium	51	1.0	50.00	0	101	80	120			

Sample ID: **2007018-001DMS** SampType: **MS** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **Injection Well #2** Batch ID: **53551** RunNo: **70197**

Prep Date: **7/7/2020** Analysis Date: **7/8/2020** SeqNo: **2439318** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.32	0.030	0.5000	0	63.1	75	125			S
Barium	0.58	0.0020	0.5000	0.2229	71.2	75	125			S
Cadmium	0.37	0.0020	0.5000	0	73.1	75	125			S
Chromium	0.32	0.0060	0.5000	0	64.2	75	125			S
Lead	0.33	0.020	0.5000	0	65.8	75	125			S
Magnesium	97	1.0	50.00	52.48	88.9	75	125			

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **2007018-001DMS** SampType: **MS** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **Injection Well #2** Batch ID: **53551** RunNo: **70197**

Prep Date: **7/7/2020** Analysis Date: **7/8/2020** SeqNo: **2439318** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	60	1.0	50.00	12.98	94.1	75	125			
Selenium	0.32	0.050	0.5000	0	63.5	75	125			S
Silver	0.074	0.0050	0.1000	0	74.0	75	125			S

Sample ID: **2007018-001DMSD** SampType: **MSD** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **Injection Well #2** Batch ID: **53551** RunNo: **70197**

Prep Date: **7/7/2020** Analysis Date: **7/8/2020** SeqNo: **2439319** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.30	0.030	0.5000	0	59.7	75	125	5.44	20	S
Barium	0.55	0.0020	0.5000	0.2229	65.3	75	125	5.26	20	S
Cadmium	0.35	0.0020	0.5000	0	69.8	75	125	4.61	20	S
Chromium	0.31	0.0060	0.5000	0	61.1	75	125	5.01	20	S
Lead	0.32	0.020	0.5000	0	63.9	75	125	2.92	20	S
Magnesium	91	1.0	50.00	52.48	76.5	75	125	6.58	20	
Potassium	56	1.0	50.00	12.98	85.7	75	125	7.22	20	
Selenium	0.30	0.050	0.5000	0	59.0	75	125	7.36	20	S
Silver	0.070	0.0050	0.1000	0	70.2	75	125	5.21	20	S

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **mb-1 alk**	SampType: **mblk**	TestCode: **SM2320B: Alkalinity**
Client ID: **PBW**	Batch ID: **R70195**	RunNo: **70195**
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439098** 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: **R70195**	RunNo: **70195**
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439099** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	76.40	20.00	80.00	0	95.5	90	110			

Sample ID: **mb-2 alk**	SampType: **mblk**	TestCode: **SM2320B: Alkalinity**
Client ID: **PBW**	Batch ID: **R70195**	RunNo: **70195**
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439121** 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-2 alk**	SampType: **lcs**	TestCode: **SM2320B: Alkalinity**
Client ID: **LCSW**	Batch ID: **R70195**	RunNo: **70195**
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439122** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	77.32	20.00	80.00	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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007018**

17-Aug-20

Client: Western Refining Southwest, Inc.

Project: Injection Well 2 2Q2020

Sample ID: **MB-53514**	SampType: **MBLK**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **PBW**	Batch ID: **53514**	RunNo: **70168**
Prep Date: **7/6/2020**	Analysis Date: **7/8/2020**	SeqNo: **2438320** 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-53514**	SampType: **LCS**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **LCSW**	Batch ID: **53514**	RunNo: **70168**
Prep Date: **7/6/2020**	Analysis Date: **7/8/2020**	SeqNo: **2438321** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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

Sample Log-In Check List

Client Name: **Western Refining Southwest, Inc.** Work Order Number: **2007018** RcptNo: 1

Received By: **Emily Mocho** **7/1/2020 8:05:00 AM**

Completed By: **Emily Mocho** **7/1/2020 10:48:41 AM**

Reviewed By: SPA 12:40 7-1-20

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 ☑ JR 7/1/20 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 ☐
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
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 ☐

# of preserved bottles checked for pH: 2 (1) (<2 or >12 unless noted)
Adjusted? yes
Checked by: JR 7/1/20

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: 0.5ml of HNO_3 was added to sample 0010 for pH<2. For metals analysis. JR 7/1/20

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	8.05	Good	Yes			

Chain-of-Custody Record

Client: Western Refining

Mailing Address: 50 CR 4990
Bloomfield NM 87413

Phone #: (505) 801-5616

email or Fax#:

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

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

Turn-Around Time:
☒ Standard ☐ Rush

Project Name:
Injection Well #2 - 2Q2020

Project #:
PO# 4500183752

Project Manager:
K. Robinson

Sampler:

On Ice: ☑ Yes ☐ No

# of Coolers: 1

Cooler Temp(including CF): 2.0 ±0 = 2.0 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

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

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No.
6/30/20		Water	Injection Well #2	~~4-500mL~~ 3 Amber	None	
				2-500mL	Poly	
				3-VOA	HCl	
				1-500mL poly	NaOH	
				1-500mL Poly	Zn Acetate NaOH	
				~~1-250ml~~ Poly	HNO3	
				1-125mL Poly	H_2SO_4	
				~~1-500mL Poly~~		

Analysis Request

BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	See Analytical List						
										X						
										X						
										X						
										X						
										X						
										X						
										X						
										X						
										X						
										X						
										X						

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
6/30/20	1204	Kelly Pedersen	Christa Waele		6/30/2020	1204
6/30/20	1820	Christa Waele	Ellen	courier	7/1/20	8:05

Remarks:
See Attached Analytical List

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.

immediately or within a specified time period, or assess a civil penalty, or both (see Section 74-6-10 NMSA 1978). The compliance order may also include a suspension or termination of this Discharge Permit. OCD may also commence a civil action in district court for appropriate relief, including injunctive relief (see Section 74-6-10(A)(2) NMSA 1978). The Permittee may be subject to criminal penalties for discharging a water contaminant without a discharge permit or in violation of a condition of a discharge permit; making any false material statement, representation, certification or omission of material fact in a renewal application, record, report, plan or other document filed, submitted or required to be maintained under the Water Quality Act; falsifying, tampering with or rendering inaccurate any monitoring device, method or record required to be maintained under the Water Quality Act; or failing to monitor, sample or report as required by a Discharge Permit issued pursuant to a state or federal law or regulation (see Section 74-6-10.2 NMSA 1978).

2. GENERAL FACILITY OPERATIONS:

2.A. QUARTERLY MONITORING REQUIREMENTS FOR CLASS I NON-HAZARDOUS WASTE INJECTION WELL: The Permittee shall properly conduct waste management injection operations at its facility by injecting only non-hazardous (RCRA exempt and RCRA non-hazardous, non-exempt) oil field waste fluids. Injected waste fluids shall not exhibit the RCRA characteristics, i.e., ignitability, reactivity, corrosivity, or toxicity under 40 CFR 261 Subpart "C" 261.21 – 261.24 (July 1, 1992), at the point of injection into WDW-2, based upon environmental analytical laboratory testing. Pursuant to 20.6.2.5207B, the Permittee shall provide analyses of the injected fluids at least quarterly to yield data representative of their toxicity characteristic.

The Permittee shall also analyze the injected fluids quarterly for the following characteristics:

- pH (Method 9040);
- Eh;
- Specific conductance;
- Specific gravity;
- Temperature;
- Major dissolved cations and anions, including: fluoride, calcium, potassium, magnesium, sodium bicarbonate, carbonate, chloride, sulfate, bromide, total dissolved solids, and cation/anion balance using the methods specified in 40 CFR 136.3); and,
- EPA RCRA Characteristics for Ignitability (ASTM Methods); Corrosivity (SW-846) and Reactivity (determined through Permittee's application of knowledge or generating process).

The Permittee shall analyze the injected fluids quarterly for the constituents identified in the Quarterly Monitoring List (below) to demonstrate that the injected fluids do not exhibit the characteristic of toxicity using the Toxicity Characteristic Leaching Procedure, EPA SW-846 Test Method 1311 (see Table 1, 40 CFR 261.24(b)).

QUARTERLY MONITORING LIST			
EPA HW No.	Contaminant	SW-846 Methods	Regulatory Level (mg/L)
D004	Arsenic	1311	5.0
D005	Barium	1311	100.0
D018	Benzene	8021B	0.5
D006	Cadmium	1311	1.0
D019	Carbon tetrachloride	8021B 8260B	0.5
D020	Chlordane	8081A	0.03
D021	Chlorobenzene	8021B 8260B	100.0
D022	Chloroform	8021B 8260B	6.0
D007	Chromium	1311	5.0
D023	o-Cresol	8270D	200.0
D024	m-Cresol	8270D	200.0
D025	p-Cresol	8270D	200.0
D026	Cresol	8270D	200.0
D027	1,4-Dichlorobenzene	8021B 8121 8260B 8270D	7.5
D028	1,2-Dichloroethane	8021B 8260B	0.5
D029	1,1-Dichloroethylene	8021B 8260B	0.7
D030	2,4-Dinitrotoluene	8091 8270D	0.13
D032	Hexachlorobenzene	8121	0.13
D033	Hexachlorobutadiene	8021B 8121 8260B	0.5
D034	Hexachloroethane	8121	3.0
D008	Lead	1311	5.0
D009	Mercury	7470A 7471B	0.2
D035	Methyl ethyl ketone	8015B 8260B	200.0
D036	Nitrobenzene	8091 8270D	2.0
D037	Pentrachlorophenol	8041	100.0
D038	Pyridine	8260B 8270D	5.0

D010	Selenium	1311	1.0
D011	Silver	1311	5.0
D039	Tetrachloroethylene	8260B	0.7
D040	Trichloroethylene	8021B 8260B	0.5
D041	2,4,5-Trichlorophenol	8270D	400.0
D042	2,4,6-Trichlorophenol	8041A 8270D	2.0
D043	Vinyl chloride	8021B 8260B	0.2

If o-, m-, and p-cresol concentrations cannot be differentiated, then the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.
If the quantitation limit is greater than the regulatory level, then the quantitation limit becomes the regulatory level.
If metals (dissolved), the EPA 1311 TCLP Laboratory Method is required with the exception of Mercury (total).

1. **Monitor and Piezometer Wells:** Groundwater with a total dissolved solids concentration of less than 10,000 mg/L occurs at an estimated depth of approximately 10 - 30 ft. below ground surface at the WDW-2 well (hereafter, "uppermost water-bearing unit"). Groundwater monitoring well (MW) with GW sampling capability shall be installed proximal to and hydrogeologically downgradient from WDW-2 in order to monitor the uppermost water-bearing unit. The MW shall be screened (15 ft. screen with top of screen positioned 5 ft. above water table) into the uppermost water-bearing unit. The Permittee shall propose a monitoring frequency with chemical monitoring parameters in order to detect potential groundwater contamination either associated with or not associated with WDW-2.

2.B. **CONTINGENCY PLANS:** The Permittee shall implement its proposed contingency plan(s) included in its application to cope with failure of a system(s) in the Discharge Permit.

2.C. **CLOSURE:** Prior to closure of the facility, the Permittee shall submit for OCD's approval, a closure plan including a completed form C-103 for plugging and abandonment of the waste injection well. The Permittee shall plug and abandon its well pursuant to 20.6.2.5209 NMAC and as specified in Permit Condition 2.D.

1. **Pre-Closure Notification:** Pursuant to 20.6.2.5005A NMAC, the Permittee shall submit a pre-closure notification to OCD's Environmental Bureau at least 30 days prior to the date that it proposes to close or to discontinue operation of WDW-2. Pursuant to 20.6.2.5005B NMAC, OCD's Environmental Bureau must approve all proposed well closure activities before the Permittee may implement its proposed closure plan.

2. **Required Information:** The Permittee shall provide OCD's Environmental Bureau with the following information in the pre-closure notification specified in Permit Condition 2.C.1:

- Name of facility;
- Address of facility;
- Name of Permittee (and owner or operator, if appropriate);

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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

July 13, 2020

Kelly Robinson

Western Refining Southwest, Inc.
#50 CR 4990
Bloomfield, NM 87413
TEL: (505) 632-4135
FAX: (505) 632-3911

RE: Evaporation Ponds OrderNo.: 2007061

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 7/1/2020 for the analyses presented in the following report.

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. In order to properly interpret your results, it is imperative that you review this report in its entirety. 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. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc.
Client Sample ID: Evap Pond South
Project: Evaporation Ponds
Collection Date: 6/30/2020 7:45:00 AM
Lab ID: 2007061-001 **Matrix:** AQUEOUS **Received Date:** 7/1/2020 8:05:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE						Analyst: **JME**	
Diesel Range Organics (DRO)	0.54	0.40		mg/L	1	7/7/2020 10:40:40 AM	53522
Motor Oil Range Organics (MRO)	ND	2.5		mg/L	1	7/7/2020 10:40:40 AM	53522
Surr: DNOP	113	81.5-152		%Rec	1	7/7/2020 10:40:40 AM	53522
SM2340B: HARDNESS						Analyst: **ags**	
Hardness (As CaCO3)	390	6.6		mg/L	1	7/7/2020 12:58:00 PM	R70149
EPA METHOD 300.0: ANIONS						Analyst: **CJS**	
Fluoride	ND	1.0		mg/L	10	7/6/2020 6:28:24 PM	R70144
Chloride	1100	50	*	mg/L	100	7/6/2020 6:41:15 PM	R70144
Bromide	3.7	1.0		mg/L	10	7/6/2020 6:28:24 PM	R70144
Phosphorus, Orthophosphate (As P)	ND	5.0	H	mg/L	10	7/6/2020 6:28:24 PM	R70144
Sulfate	79	5.0		mg/L	10	7/6/2020 6:28:24 PM	R70144
Nitrate+Nitrite as N	ND	2.0		mg/L	10	7/6/2020 6:54:07 PM	R70144
SM2510B: SPECIFIC CONDUCTANCE						Analyst: **JRR**	
Conductivity	4600	10		µmhos/c	1	7/7/2020 1:18:10 PM	R70195
SM2320B: ALKALINITY						Analyst: **JRR**	
Bicarbonate (As CaCO3)	653.3	20.00		mg/L Ca	1	7/7/2020 1:18:10 PM	R70195
Carbonate (As CaCO3)	ND	2.000		mg/L Ca	1	7/7/2020 1:18:10 PM	R70195
Total Alkalinity (as CaCO3)	653.3	20.00		mg/L Ca	1	7/7/2020 1:18:10 PM	R70195
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**	
Total Dissolved Solids	2660	200	*D	mg/L	1	7/8/2020 6:10:00 PM	53532
EPA METHOD 200.7: METALS						Analyst: **ags**	
Calcium	72	1.0		mg/L	1	7/7/2020 2:19:40 PM	53509
Iron	1.7	0.25	*	mg/L	5	7/7/2020 2:21:25 PM	53509
Magnesium	52	1.0		mg/L	1	7/7/2020 2:19:40 PM	53509
Manganese	0.20	0.0020	*	mg/L	1	7/7/2020 2:19:40 PM	53509
Potassium	13	1.0		mg/L	1	7/7/2020 2:19:40 PM	53509
Sodium	840	10		mg/L	10	7/7/2020 3:10:25 PM	53509
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	0.11	0.10		mg/L	2	7/9/2020 2:37:38 PM	GW7022
Surr: BFB	104	70-130		%Rec	2	7/9/2020 2:37:38 PM	GW7022
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Toluene	12	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Ethylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Methyl tert-butyl ether (MTBE)	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228

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

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc.
Client Sample ID: Evap Pond South
Project: Evaporation Ponds
Collection Date: 6/30/2020 7:45:00 AM
Lab ID: 2007061-001 **Matrix:** AQUEOUS **Received Date:** 7/1/2020 8:05:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,2,4-Trimethylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,3,5-Trimethylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2-Dichloroethane (EDC)	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2-Dibromoethane (EDB)	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Naphthalene	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1-Methylnaphthalene	ND	8.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
2-Methylnaphthalene	ND	8.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Acetone	120	20		µg/L	2	7/9/2020 2:37:38 PM	W70228
Bromobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Bromodichloromethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Bromoform	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Bromomethane	ND	6.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
2-Butanone	ND	20		µg/L	2	7/9/2020 2:37:38 PM	W70228
Carbon disulfide	ND	20		µg/L	2	7/9/2020 2:37:38 PM	W70228
Carbon Tetrachloride	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Chlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Chloroethane	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Chloroform	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Chloromethane	ND	6.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
2-Chlorotoluene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
4-Chlorotoluene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
cis-1,2-DCE	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
cis-1,3-Dichloropropene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2-Dibromo-3-chloropropane	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Dibromochloromethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Dibromomethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2-Dichlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,3-Dichlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,4-Dichlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Dichlorodifluoromethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1-Dichloroethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1-Dichloroethene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2-Dichloropropane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,3-Dichloropropane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
2,2-Dichloropropane	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1-Dichloropropene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Hexachlorobutadiene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
2-Hexanone	ND	20		µg/L	2	7/9/2020 2:37:38 PM	W70228
Isopropylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228

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	Value above quantitation range
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 range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Western Refining Southwest, Inc.
Client Sample ID: Evap Pond South
Project: Evaporation Ponds
Collection Date: 6/30/2020 7:45:00 AM
Lab ID: 2007061-001 **Matrix:** AQUEOUS **Received Date:** 7/1/2020 8:05:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
4-Isopropyltoluene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
4-Methyl-2-pentanone	ND	20		µg/L	2	7/9/2020 2:37:38 PM	W70228
Methylene Chloride	ND	6.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
n-Butylbenzene	ND	6.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
n-Propylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
sec-Butylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Styrene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
tert-Butylbenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1,1,2-Tetrachloroethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1,2,2-Tetrachloroethane	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Tetrachloroethene (PCE)	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
trans-1,2-DCE	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
trans-1,3-Dichloropropene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2,3-Trichlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2,4-Trichlorobenzene	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1,1-Trichloroethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,1,2-Trichloroethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Trichloroethene (TCE)	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Trichlorofluoromethane	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
1,2,3-Trichloropropane	ND	4.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Vinyl chloride	ND	2.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Xylenes, Total	9.6	3.0		µg/L	2	7/9/2020 2:37:38 PM	W70228
Surr: 1,2-Dichloroethane-d4	104	70-130		%Rec	2	7/9/2020 2:37:38 PM	W70228
Surr: 4-Bromofluorobenzene	91.6	70-130		%Rec	2	7/9/2020 2:37:38 PM	W70228
Surr: Dibromofluoromethane	101	70-130		%Rec	2	7/9/2020 2:37:38 PM	W70228
Surr: Toluene-d8	99.8	70-130		%Rec	2	7/9/2020 2:37:38 PM	W70228

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	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **MBLK-53509**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Metals**
Client ID: **PBW**	Batch ID: **53509**	RunNo: **70149**
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437613** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Iron	ND	0.050								
Magnesium	ND	1.0								
Manganese	ND	0.0020								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID: **LLLCS-53509**	SampType: **LCSLL**	TestCode: **EPA Method 200.7: Metals**
Client ID: **BatchQC**	Batch ID: **53509**	RunNo: **70149**
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437614** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0	0.5000	0	110	50	150			
Iron	ND	0.050	0.02000	0	111	50	150			
Magnesium	ND	1.0	0.5000	0	106	50	150			
Manganese	0.0020	0.0020	0.002000	0	102	50	150			
Potassium	ND	1.0	0.5000	0	78.7	50	150			
Sodium	ND	1.0	0.5000	0	134	50	150			

Sample ID: **LCS-53509**	SampType: **LCS**	TestCode: **EPA Method 200.7: Metals**
Client ID: **LCSW**	Batch ID: **53509**	RunNo: **70149**
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437615** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	49	1.0	50.00	0	97.3	85	115			
Iron	0.47	0.050	0.5000	0	93.7	85	115			
Magnesium	49	1.0	50.00	0	98.2	85	115			
Manganese	0.46	0.0020	0.5000	0	91.1	85	115			
Potassium	48	1.0	50.00	0	95.7	85	115			
Sodium	49	1.0	50.00	0	98.8	85	115			

Qualifiers:

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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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **MB**	SampType: **mblk**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R70144**	RunNo: **70144**
Prep Date:	Analysis Date: **7/6/2020**	SeqNo: **2437459** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Bromide	ND	0.10								
Phosphorus, Orthophosphate (As P	ND	0.50								
Sulfate	ND	0.50								
Nitrate+Nitrite as N	ND	0.20								

Sample ID: **LCS**	SampType: **lcs**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R70144**	RunNo: **70144**
Prep Date:	Analysis Date: **7/6/2020**	SeqNo: **2437460** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.46	0.10	0.5000	0	91.4	90	110			
Chloride	4.8	0.50	5.000	0	95.5	90	110			
Bromide	2.4	0.10	2.500	0	97.2	90	110			
Phosphorus, Orthophosphate (As P	4.6	0.50	5.000	0	93.0	90	110			
Sulfate	9.6	0.50	10.00	0	96.4	90	110			
Nitrate+Nitrite as N	3.4	0.20	3.500	0	95.9	90	110			

Qualifiers:

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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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **MB-53522**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Diesel Range**							
Client ID: **PBW**	Batch ID: **53522**	RunNo: **70147**							
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437591**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	0.40								
Motor Oil Range Organics (MRO)	ND	2.5								
Surr: DNOP	0.51		0.5000		101	81.5	152			

Sample ID: **LCS-53522**	SampType: **LCS**	TestCode: **EPA Method 8015D: Diesel Range**							
Client ID: **LCSW**	Batch ID: **53522**	RunNo: **70147**							
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437592**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	3.1	0.40	2.500	0	123	82	138			
Surr: DNOP	0.25		0.2500		99.2	81.5	152			

Sample ID: **2007061-001BMS**	SampType: **MS**	TestCode: **EPA Method 8015D: Diesel Range**							
Client ID: **Evap Pond South**	Batch ID: **53522**	RunNo: **70147**							
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437594**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	3.5	0.40	2.500	0.5436	118	70.1	159			
Surr: DNOP	0.30		0.2500		120	81.5	152			

Sample ID: **2007061-001BMSD**	SampType: **MSD**	TestCode: **EPA Method 8015D: Diesel Range**							
Client ID: **Evap Pond South**	Batch ID: **53522**	RunNo: **70147**							
Prep Date: **7/6/2020**	Analysis Date: **7/7/2020**	SeqNo: **2437595**	Units: **mg/L**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	3.4	0.40	2.500	0.5436	115	70.1	159	1.96	20	
Surr: DNOP	0.30		0.2500		119	81.5	152	0	0	

Qualifiers:

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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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **mb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **W70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440715** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **mb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **W70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440715** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.9		10.00		98.6	70	130			
Surr: 4-Bromofluorobenzene	9.1		10.00		91.4	70	130			
Surr: Dibromofluoromethane	10		10.00		99.8	70	130			
Surr: Toluene-d8	10		10.00		100	70	130			

Sample ID: **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **W70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440716** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	111	70	130			
Toluene	21	1.0	20.00	0	106	70	130			
Chlorobenzene	20	1.0	20.00	0	101	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **100ng lcs** SampType: **LCS** TestCode: **EPA Method 8260B: VOLATILES**

Client ID: **LCSW** Batch ID: **W70228** RunNo: **70228**

Prep Date: Analysis Date: **7/9/2020** SeqNo: **2440716** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	22	1.0	20.00	0	109	70	130			
Trichloroethene (TCE)	19	1.0	20.00	0	95.3	70	130			
Surr: 1,2-Dichloroethane-d4	9.5		10.00		95.2	70	130			
Surr: 4-Bromofluorobenzene	9.3		10.00		92.8	70	130			
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.7		10.00		97.4	70	130			

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **lcs-1 99.5uS eC**	SampType: **lcs**			TestCode: **SM2510B: Specific Conductance**						
Client ID: **LCSW**	Batch ID: **R70195**			RunNo: **70195**						
Prep Date:	Analysis Date: **7/7/2020**			SeqNo: **2439134**		Units: **µmhos/cm**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	99	10	99.50	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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **mb1**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBW**	Batch ID: **GW70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440763** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	11		10.00		105	70	130			

Sample ID: **2.5ug gro lcs**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSW**	Batch ID: **GW70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440764** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.48	0.050	0.5000	0	96.7	70	130			
Surr: BFB	10		10.00		102	70	130			

Sample ID: **2007061-001ams**	SampType: **MS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **Evap Pond South**	Batch ID: **GW70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440766** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	1.1	0.10	1.000	0.1140	99.4	70	130			
Surr: BFB	21		20.00		104	70	130			

Sample ID: **2007061-001amsd**	SampType: **MSD**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **Evap Pond South**	Batch ID: **GW70228**	RunNo: **70228**
Prep Date:	Analysis Date: **7/9/2020**	SeqNo: **2440767** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	1.1	0.10	1.000	0.1140	95.2	70	130	3.86	20	
Surr: BFB	21		20.00		103	70	130	0	0	

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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **mb-1 alk**	SampType: **mblk**	TestCode: **SM2320B: Alkalinity**							
Client ID: **PBW**	Batch ID: **R70195**	RunNo: **70195**							
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439098**	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: **R70195**	RunNo: **70195**							
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439099**	Units: **mg/L CaCO3**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	76.40	20.00	80.00	0	95.5	90	110			

Sample ID: **mb-2 alk**	SampType: **mblk**	TestCode: **SM2320B: Alkalinity**							
Client ID: **PBW**	Batch ID: **R70195**	RunNo: **70195**							
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439121**	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-2 alk**	SampType: **lcs**	TestCode: **SM2320B: Alkalinity**							
Client ID: **LCSW**	Batch ID: **R70195**	RunNo: **70195**							
Prep Date:	Analysis Date: **7/7/2020**	SeqNo: **2439122**	Units: **mg/L CaCO3**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	77.32	20.00	80.00	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 range due to dilution or matrix
B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2007061**

13-Jul-20

Client: Western Refining Southwest, Inc.

Project: Evaporation Ponds

Sample ID: **MB-53532**	SampType: **MBLK**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **PBW**	Batch ID: **53532**	RunNo: **70189**
Prep Date: **7/7/2020**	Analysis Date: **7/8/2020**	SeqNo: **2438885** 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-53532**	SampType: **LCS**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **LCSW**	Batch ID: **53532**	RunNo: **70189**
Prep Date: **7/7/2020**	Analysis Date: **7/8/2020**	SeqNo: **2438886** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	995	20.0	1000	0	99.5	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
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 range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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

Sample Log-In Check List

Client Name: Western Refining Southwest, Inc.

Work Order Number: 2007061

RcptNo: 1

Received By: **Emily Mocho** 7/1/2020 8:05:00 AM

Completed By: **John Caldwell** 7/1/2020 2:33:35 PM John Caldwell

Reviewed By: SPA 7.2.20

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 ☐
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
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 ☐

# of preserved bottles checked for pH: 2 (<2 or >12 unless noted)

Adjusted? no

Checked by: EM 7/2/20

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:

17. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	2.0	Good				

Chain-of-Custody Record

Client: Western Refining

Mailing Address: 50 CR 4990
Bloomfield, NM 87413

Phone #: (505) 801-5616

email or Fax#:

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

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other

☒ EDD (Type) Excel

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: Evaporation Ponds

Project #: PO# 4500193752

Project Manager: R. Robinson

Sampler:

On Ice: ☒ Yes ☐ No

# of Coolers: 1

Cooler Temp(including CF): 2.0 (°C)

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. 2007061	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	Sean Chavez - See attached
6/30/20	7:45	Water	Evap Pond-South	5 VOAs	HCl	-001		X						X			
				(1) 250mL Amber	—			X									
				(2) Poly 500mL	—												X
				(1) Poly 125mL	Sulfuric Acid												X
				(1) Poly 250mL	~~H~~ HNO_3												X
	8:15		Evap Pond-North	~~5 VOA~~	HCl			X						X			
6/30/20	8:15	Water	Evap Pond-North	(1) 250mL Amber	—			X									
				(2) Poly 500mL	—												X
				~~(1) Poly 125mL~~	~~H_2SO_4~~												X
				(1) poly 250	HNO_3												X

Date	Time	Relinquished by	Received by	Via	Date	Time
6/30/20	1710	Kelly Robinson	Ernest Waller		6/30/2020	1710
6/30/2020	1824	Ernest Waller	EKM	courier	7/1/20	8:05

Remarks: No North Sample.

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.

GWC		
pH	SM 4500-H+B	1 - 500ml (non preserved)
EC	SM 2510B	
TDS	SM 2540C MOD	
alkalinity	SM 2320B	
hardness	SM 2340B	
ANIONS	EPA Method 300.0	
	nitrate nitrite	1 - 250ml H2SO4
	bromide	1 - 500ml HNO3
	chloride	
	sulfate	
	phosporus	
	fluoride	
CATIONS / METALS	EPA Method 200.7	
	calcium	
	iron	
	magnesium	
	manganese	
	potassium	
	sodium	
Metals	EPA Method 200.7	1 - 500ml HNO3
	barium	
	beryllium	
	cadmium	
	chromium	
	silver	
	lead	
	nickel	
	EPA 200.8	
	copper	
	zinc	
	antimony	
	arsenic	
	selenium	
	thallium	
	Epa Method 245.1	
	mercury	

General Chemistry

APPENDIX D

DAILY RATE HISTORY

APPENDIX D

WDW#2
Daily Injection Rates and Pressures

Date/Time	WDW#2 Daily Rates (gpm)	WDW#2 Pressure (psig)
05/28/20 00:00	0	595
05/29/20 00:00	27	1233
05/30/20 00:00	26	1316
05/31/20 00:00	0	984
06/01/20 00:00	0	791
06/02/20 00:00	0	740
06/03/20 00:00	0	713
06/04/20 00:00	0	694
06/05/20 00:00	0	681
06/06/20 00:00	0	670
06/07/20 00:00	0	661
06/08/20 00:00	0	653
06/09/20 00:00	0	647
06/10/20 00:00	0	641
06/11/20 00:00	0	636
06/12/20 00:00	0	631
06/13/20 00:00	0	627
06/14/20 00:00	0	623
06/15/20 00:00	0	619
06/16/20 00:00	0	616
06/17/20 00:00	0	613
06/18/20 00:00	0	610
06/19/20 00:00	0	607
06/20/20 00:00	0	605
06/21/20 00:00	0	602
06/22/20 00:00	0	600
06/23/20 00:00	0	597
06/24/20 00:00	0	772
06/25/20 00:00	0	636
06/26/20 00:00	0	618
06/27/20 00:00	0	610
06/28/20 00:00	0	605
06/29/20 00:00	0	601
06/30/20 00:00	33	1252
07/01/20 00:00	0	919
07/02/20 00:00	0	733
07/03/20 00:00	0	690
07/04/20 00:00	0	669
07/05/20 00:00	0	655
07/06/20 00:00	0	644
07/07/20 00:00	0	636

APPENDIX D

WDW#2
Daily Injection Rates and Pressures

Date/Time	WDW#2 Daily Rates (gpm)	WDW#2 Pressure (psig)
07/08/20 00:00	0	629
07/09/20 00:00	0	624
07/10/20 00:00	0	618
07/11/20 00:00	0	614
07/12/20 00:00	0	610
07/13/20 00:00	0	607
07/14/20 00:00	0	603
07/15/20 00:00	0	600
07/16/20 00:00	0	597
07/17/20 00:00	0	595
07/18/20 00:00	0	592
07/19/20 00:00	0	590
07/20/20 00:00	0	588
07/21/20 00:00	0	586
07/22/20 00:00	0	584
07/23/20 00:00	0	582
07/24/20 00:00	0	580
07/25/20 00:00	0	578
07/26/20 00:00	0	576
07/27/20 00:00	0	575
07/28/20 00:00	0	573
07/29/20 00:00	0	572
07/30/20 00:00	0	570
07/31/20 00:00	0	569
08/01/20 00:00	0	567
08/02/20 00:00	0	566
08/03/20 00:00	0	565
08/04/20 00:00	0	563
08/05/20 00:00	0	562
08/06/20 00:00	0	561
08/07/20 00:00	0	560
08/08/20 00:00	0	559
08/09/20 00:00	0	557
08/10/20 00:00	0	556
08/11/20 00:00	0	555
08/12/20 00:00	0	554
08/13/20 00:00	0	553
08/14/20 00:00	0	552
08/15/20 00:00	0	551
08/16/20 00:00	0	550
08/17/20 00:00	0	549

APPENDIX D

WDW#2
Daily Injection Rates and Pressures

Date/Time	WDW#2 Daily Rates (gpm)	WDW#2 Pressure (psig)
08/18/20 00:00	0	548
08/19/20 00:00	0	547
08/20/20 00:00	0	546
08/21/20 00:00	0	545
08/22/20 00:00	0	544
08/23/20 00:00	0	544
08/24/20 00:00	0	543
08/25/20 00:00	0	542
08/26/20 00:00	0	541
08/27/20 00:00	0	540
08/28/20 00:00	0	540
08/29/20 00:00	0	539
08/30/20 00:00	0	538
08/31/20 00:00	0	537
09/01/20 00:00	0	536
09/02/20 00:00	0	535
09/03/20 00:00	0	535
09/04/20 00:00	0	534
09/05/20 00:00	0	533
09/06/20 00:00	0	533
09/07/20 00:00	0	532
09/08/20 00:00	0	531
09/09/20 00:00	0	531
09/10/20 00:00	0	530
09/11/20 00:00	0	529
09/12/20 00:00	0	528
09/13/20 00:00	0	528
09/14/20 00:00	0	527
09/15/20 00:00	0	527
09/16/20 00:00	0	526
09/17/20 00:00	0	525
09/18/20 00:00	0	534
09/19/20 00:00	23	1064
09/20/20 00:00	22	1180
09/21/20 14:24	22	1291

APPENDIX E

GAUGE CALIBRATION CERTIFICATES

ACCURACY VERIFICATION

10-March-2020

Gauge Model	**SP-2000**	Pressure Range	**5 K**
Gauge S/N	**240**	Accuracy 0.05%	Full Scale

Applied Pressure psig	**Recorded Pressure psig**	**Difference psi**	**Percent (%)**
0.01	0.01	0.00	0.0000%
774.08	772.99	-1.09	-0.0218%
1498.24	1496.97	-1.27	-0.0254%
2222.36	2221.20	-1.16	-0.0232%
2946.53	2945.44	-1.09	-0.0218%
3670.66	3669.59	-1.07	-0.0214%
4394.87	4393.80	-1.07	-0.0214%
5119.00	5118.01	-0.99	-0.0198%
4394.87	4393.83	-1.04	-0.0208%
3670.66	3669.56	-1.10	-0.0220%
2946.53	2945.51	-1.02	-0.0204%
2222.36	2221.22	-1.14	-0.0228%
1498.24	1496.99	-1.25	-0.0250%
774.08	772.81	-1.27	-0.0254%
0.01	0.01	0.00	0.0000%

Oven Temperature: **218.7** °F Probe Temperature: **218.6** °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00
Serial #26618, Mass Set Serial #25608
Compensated to local acceleration due to gravity

Verified by: CM

ACCURACY VERIFICATION

10-March-2020

Gauge Model	**SP-2000**	Pressure Range	**5 K**
Gauge S/N	**240**	Accuracy 0.05%	Full Scale

Applied Pressure psig	**Recorded Pressure psig**	**Difference psi**	**Percent (%)**
0.01	2.38	2.37	0.0474%
774.08	776.30	2.22	0.0444%
1498.24	1500.18	1.94	0.0388%
2222.36	2224.29	1.93	0.0386%
2946.53	2948.24	1.71	0.0342%
3670.66	3672.19	1.53	0.0306%
4394.87	4396.25	1.38	0.0276%
5119.00	5120.28	1.28	0.0256%
4394.87	4396.11	1.24	0.0248%
3670.66	3671.87	1.21	0.0242%
2946.53	2947.80	1.27	0.0254%
2222.36	2223.58	1.22	0.0244%
1498.24	1499.16	0.92	0.0184%
774.08	775.38	1.30	0.0260%
0.01	1.82	1.81	0.0362%

Oven Temperature: **254.1** °F Probe Temperature: **253.4** °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00
Serial #26618, Mass Set Serial #25608
Compensated to local acceleration due to gravity

Verified by: CM

ACCURACY VERIFICATION

10-March-2020

Gauge Model	**SP-2000**	Pressure Range	**5 K**
Gauge S/N	**262**	Accuracy 0.05%	Full Scale

Applied Pressure psig	**Recorded Pressure psig**	**Difference psi**	**Percent (%)**
0.01	1.00	0.99	0.0198%
774.08	774.85	0.77	0.0154%
1498.24	1499.96	1.72	0.0344%
2222.36	2222.84	0.48	0.0096%
2946.53	2947.01	0.48	0.0096%
3670.66	3671.21	0.55	0.0110%
4394.87	4395.43	0.56	0.0112%
5119.00	5119.62	0.62	0.0124%
4394.87	4395.86	0.99	0.0198%
3670.66	3671.85	1.19	0.0238%
2946.53	2947.85	1.32	0.0264%
2222.36	2223.50	1.14	0.0228%
1498.24	1499.51	1.27	0.0254%
774.08	775.37	1.29	0.0258%
0.01	1.52	1.51	0.0302%

Oven Temperature: **218.9** °F Probe Temperature: **218.6** °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00
Serial #26618, Mass Set Serial #25608
Compensated to local acceleration due to gravity

Verified by: CM

ACCURACY VERIFICATION

10-March-2020

Gauge Model	**SP-2000**	Pressure Range	**5 K**
Gauge S/N	**262**	Accuracy 0.05%	Full Scale

Applied Pressure psig	**Recorded Pressure psig**	**Difference psi**	**Percent (%)**
0.01	1.40	1.39	0.0278%
774.08	774.85	0.77	0.0154%
1498.24	1499.96	1.72	0.0344%
2222.36	2222.84	0.48	0.0096%
2946.53	2947.01	0.48	0.0096%
3670.66	3671.51	0.85	0.0170%
4394.87	4395.43	0.56	0.0112%
5119.00	5119.62	0.62	0.0124%
4394.87	4395.86	0.99	0.0198%
3670.66	3671.85	1.19	0.0238%
2946.53	2947.80	1.27	0.0254%
2222.36	2223.52	1.16	0.0232%
1498.24	1499.51	1.27	0.0254%
774.08	775.37	1.29	0.0258%
0.01	1.52	1.51	0.0302%

Oven Temperature: **254.1** °F Probe Temperature: **253.4** °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00
Serial #26618, Mass Set Serial #25608
Compensated to local acceleration due to gravity

Verified by: CM

APPENDIX F

PANSYSTEM© ANALYSIS OUTPUT

Company	Western Refining Company
Well	Waste Disposal Well No. 2
Location	Bloomfield, New Mexico
Test	Pressure Buildup/Falloff Test
Date	
Gauge Depth	7312
Gauge Type/Serial Number	Micro-Smart Systems/SP2000/#240
Analyst	LKM
WSP USA Project No.	N/A

Reservoir Description

Fluid type : Water
Well orientation : Vertical
Number of wells : 1
Number of layers : 1

Layer Parameters Data

	Entrada Sandstone
Formation thickness	123.0000 ft
Average formation porosity	0.1490
Water saturation	0.0000
Gas saturation	0.0000
Formation compressibility	0.000000 psi-1
Total system compressibility	4.4400e-6 psi-1
Layer pressure	3632.369000 psia
Temperature	181.710000 deg F

Well Parameters Data

	WDW-2
Well radius	0.3281 ft
Distance from observation to active well	0.000000 ft
Wellbore storage coefficient	0.02338 bbl/psi
Storage Amplitude	0.000000 psi
Storage Time Constant	0.000000 hr
Second Wellbore Storage	0.000000 bbl/psi
Time Change for Second Storage	0.000000 hr
Well offset - x direction	0.0000 ft
Well offset - y direction	0.0000 ft

Fluid Parameters Data

	Entrada Sandstone
Oil gravity	0.000000 API
Gas gravity	0.000000 sp grav
Gas-oil ratio (produced)	0.000000 scf/STB
Water cut	0.000000
Water salinity	0.000000 ppm
Check Pressure	3698.530000 psia
Check Temperature	181.710000 deg F
Gas-oil ratio (solution)	0.000000 scf/STB
Bubble-point pressure	0.000000 psia
Oil density	0.000 lb/ft3

Fluid Parameters Data (cont)

	Entrada Sandstone
Oil viscosity	0.000 cp
Oil formation volume factor	0.000 RB/STB
Gas density	0.000 lb/ft3
Gas viscosity	0.0 cp
Gas formation volume factor	0.000 ft3/scf
Water density	62.1852 lb/ft3
Water viscosity	0.470 cp
Water formation volume factor	1.000 RB/STB
Oil compressibility	0.000000 psi-1
Initial Gas compressibility	0.000000 psi-1
Water compressibility	2.9753e-6 psi-1

Entrada Sandstone Correlations

Not Used

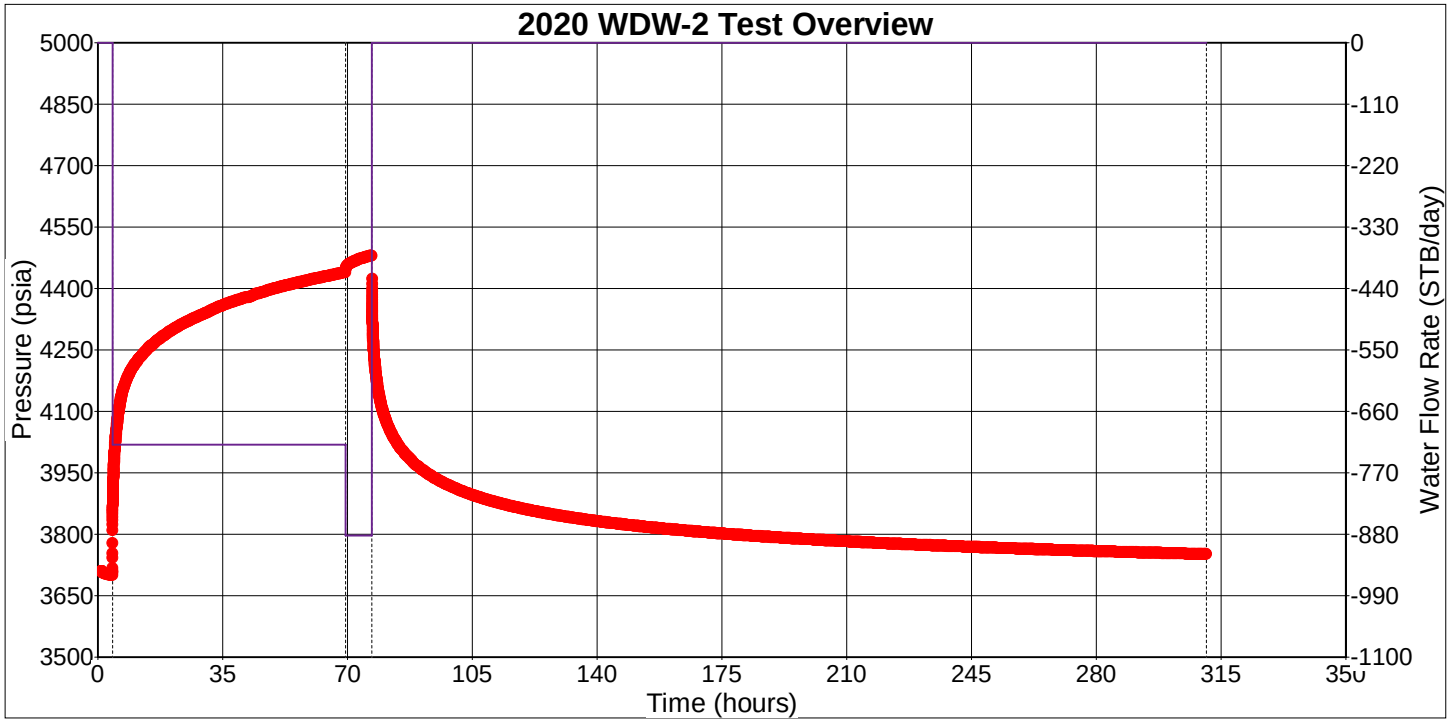
Entrada Sandstone Model Data

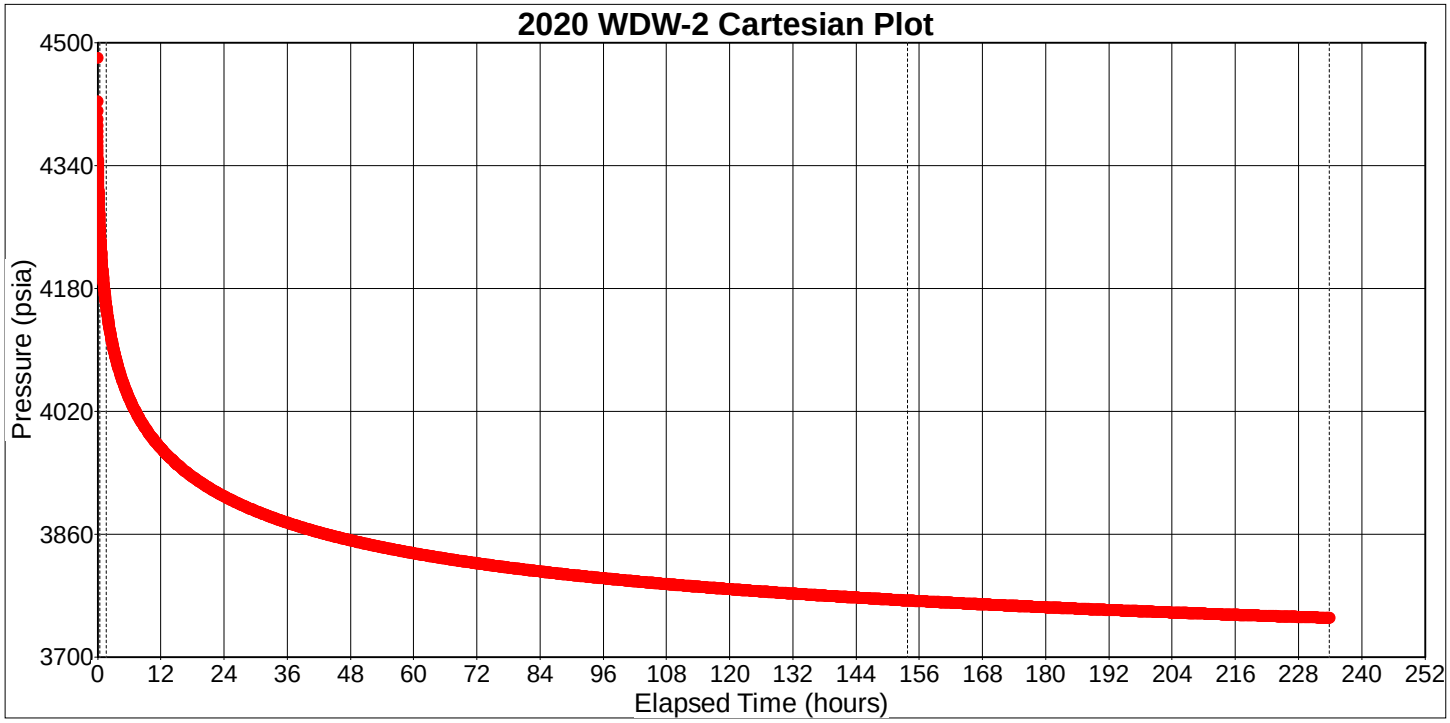
Entrada Sandstone Model Type : Vertical fracture - finite conductivity

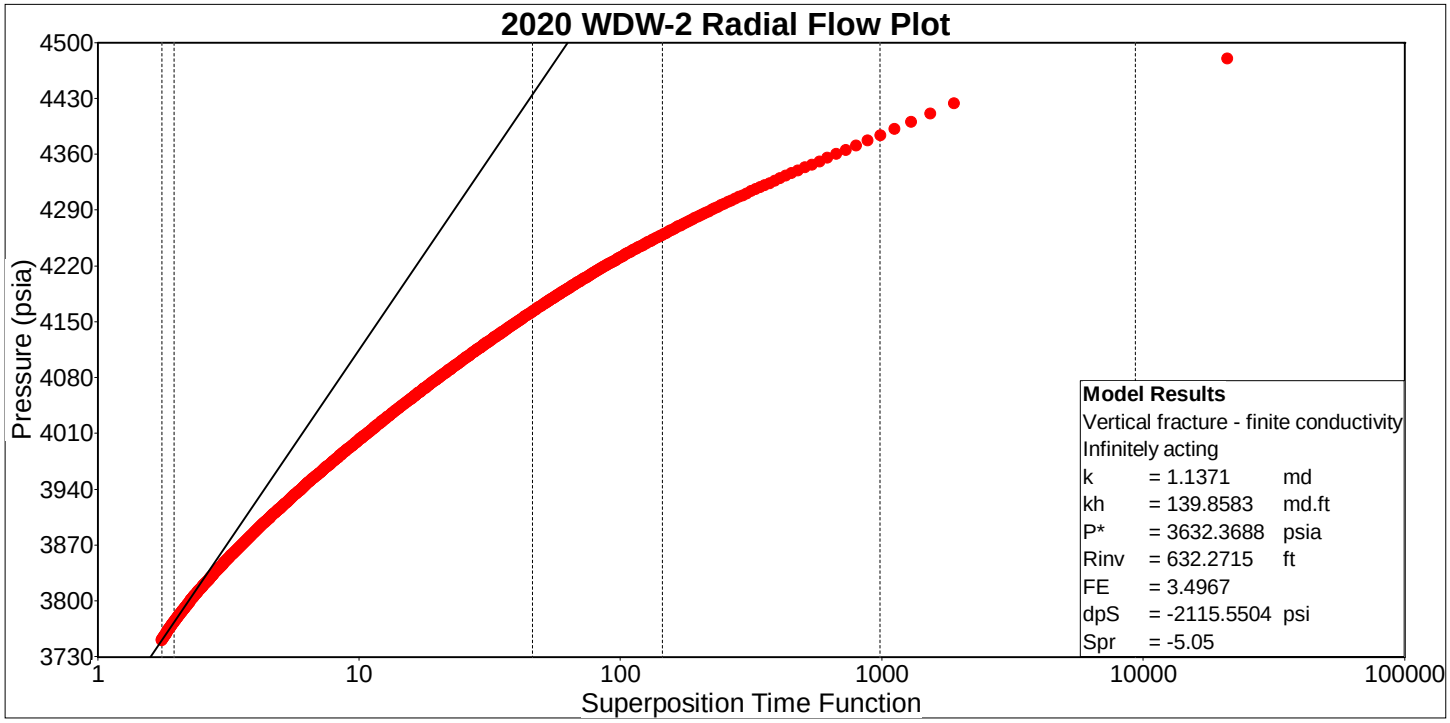
	Entrada Sandstone
Permeability	1.13706 md
Fracture face skin	0.0000
Fracture half-length	137.4750 ft
Dimensionless fracture conductivity	1.091280

Rate Change Data

Time Hours	Pressure psia	Rate STB/day
-2745.566670	0.000000	-922.520000
-2682.566670	0.000000	0.000000
-1970.566670	0.000000	-1095.880000
4.133330	3698.530000	0.000000
69.596255	4439.165000	-720.000000
76.963378	4479.706000	-882.860000
310.999696	3750.402000	0.000000


2020 WDW-2 Test Overview
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
5000
4850
4700
4550
4400
4250
4100
3950
3800
3650
3500
0
-110
-220
-330
-440
-550
-660
-770
-880
-990
-1100
0
35
70
105
140
175
210
245
280
315
350


2020 WDW-2 Cartesian Plot
Pressure (psia)
4500
4340
4180
4020
3860
3700
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
180
192
204
216
228
240
252
Elapsed Time (hours)



2020 WDW-2 Radial Flow Plot Model Results

Vertical fracture - finite conductivity - Infinitely acting

Classic Wellbore Storage

	Value
Permeability	1.13706 md
Permeability-thickness	139.858329 md.ft
Extrapolated pressure	3632.368779 psia
Radius of investigation	632.271493 ft
Flow efficiency	3.496704
dP skin (constant rate)	-2115.550411 psi
Pseudo-radial skin factor	-5.049953

2020 WDW-2 Radial Flow Plot Line Details

Line type : Pseudo-radial flow

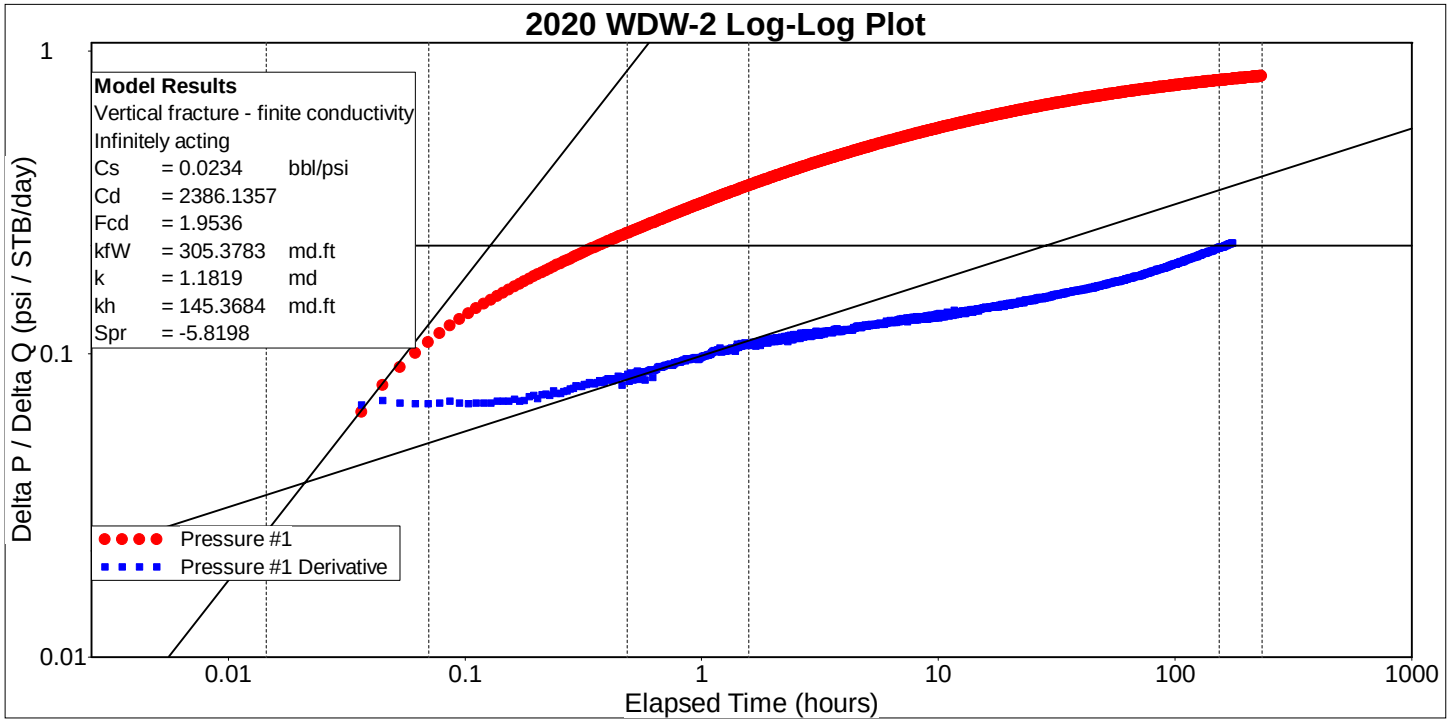
Slope : 482.305

Intercept : 3632.37

Coefficient of Determination : 0.999736

	Pseudo-radial flow
Extrapolated pressure	3632.368779 psia
Pressure at dt = 1 hour	4522.643982 psia

Number of Intersections = 0



2020 WDW-2 Log-Log Plot Model Results
Vertical fracture - finite conductivity - Infinitely acting

Classic Wellbore Storage

	Value
Wellbore storage coefficient	0.02338 bbl/psi
Dimensionless wellbore storage	2386.135683
Dimensionless fracture conductivity	1.953579
Fracture conductivity	305.378305 md.ft
Permeability	1.181857 md
Permeability-thickness	145.368424 md.ft
Pseudo-radial skin factor	-5.819792

2020 WDW-2 Log-Log Plot Line Details
Line type : Wellbore storage
Slope : 1
Intercept : 1.78215
Coefficient of Determination : Not Used

Line type : Fracture bilinear flow
Slope : 0.25
Intercept : 0.0988643
Coefficient of Determination : Not Used

Line type : Pseudo-radial flow
Slope : 0
Intercept : 0.228261
Coefficient of Determination : Not Used

Number of Intersections = 0