



BEFORE THE OIL & GAS CONSERVATION COMMISSION  
OF THE STATE OF COLORADO

**RECEIVED**  
SEP - 4 2013  
**COGCC**

IN THE MATTER OF THE APPLICATION OF  
CARRIZO OIL AND GAS, INC., FOR AN  
ORDER ALLOWING UP TO SIXTEEN  
HORIZONTAL WELLS IN AN ESTABLISHED  
640-ACRE DRILLING UNIT LOCATED IN  
SECTION 36, TOWNSHIP 9 NORTH, RANGE  
59 WEST IN WELD COUNTY, COLORADO

Cause No. 535

Docket No. 1309-AW-54

ORIGINAL

REQUEST FOR RECOMMENDATION OF  
APPROVAL OF APPLICATION WITHOUT A HEARING

Carrizo Oil and Gas, Inc. ("Applicant"), by and through its undersigned attorneys, hereby requests pursuant to Rule 511.a. of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission for the Director to recommend approval of its July 18, 2013 verified application ("Application") and the supporting exhibits without a hearing.

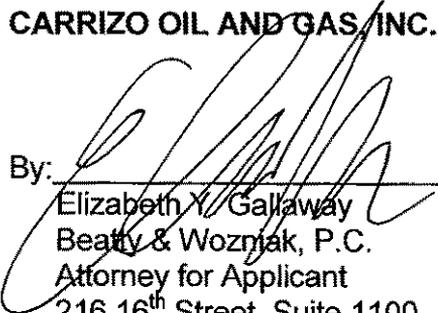
Applicant requests that the above-captioned matter be approved based upon: (i) the merits of the Application, and (ii) Applicant's sworn written testimony verifying sufficient facts along with exhibits that adequately support the relief requested in the Application. To Applicant's information and belief, no protests were timely filed in this matter.

WHEREFORE, Applicant requests that its request for a recommendation for approval of its Application without a hearing be granted.

DATED this 3<sup>rd</sup> day of September, 2013.

Respectfully submitted,

**CARRIZO OIL AND GAS, INC.**

By:   
Elizabeth Y. Gallaway  
Beatty & Wozniak, P.C.  
Attorney for Applicant  
216 16<sup>th</sup> Street, Suite 1100  
Denver, Colorado 80202  
(303) 407-4499

*CARRIZO OIL  
& GAS, INC.*

Cause No. 535  
Docket No. 1309-AW-54

Land Testimony – Craig Wiest  
Unnamed Field  
Cause No. 535; Docket No. 1309-AW-54  
Increased Density Application  
Niobrara Formation

July 2013 Colorado Oil and Gas Conservation Commission Hearing

My name is Craig E. Wiest, and I am currently Land Manager - Western US for Carrizo Oil and Gas, Inc. (“Carrizo”). I have over sixteen (16) years of experience as a landman and have been employed since June, 2011 with Carrizo and have worked directly with the properties that are subject of this matter.

In support of Carrizo’s application today, I have prepared one exhibit. The exhibit is attached to my sworn testimony and forms the basis for the above-referenced application (“Application”) which requests an order to allow up to sixteen horizontal wells in an approximate 1,280-acre drilling and spacing unit in the following-described lands:

Township 9 North, Range 59 West, 6th P.M.  
Section 36: All

Weld County, Colorado (hereafter “Application Lands”).

The Application also requests that internal wellbores be offset by 300 feet and unit boundary setbacks of 300 feet.

1. Exhibit No. 1

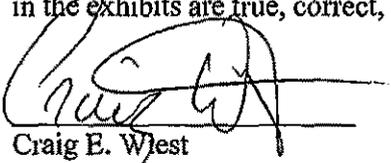
Exhibit No. 1 is the Well Location Plat that shows the Application Lands.

I certify that Carrizo is an owner with the right to drill wells in the subject unit by virtue of its leasehold interests, and is therefore qualified to apply for the requested relief pursuant to C.R.S. 34-60-116 and Rule 507(b)(1). All of the other owners in the proposed unit that were known to Carrizo (and who could be located) at the time that this application was filed with the Commission received notice of thereof at least twenty (20) days prior to the hearing on this matter. As of the date of this testimony, no timely protest has been filed in this matter.

The matters described herein were all conducted under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and in the exhibits are true, correct, and accurate.

**Affirmation**

The matters described herein were all conducted under my direction and control. I hereby swear that to the best of my knowledge and belief, all of the matters set forth herein and in the exhibits are true, correct, and accurate.



Craig E. Wiest  
Land Manager, Western US  
Carrizo Oil and Gas, Inc.

State of Texas )  
County of HARRIS ) ss.

The foregoing instrument was subscribed and sworn to before me this 16 day of August, 2013, by Craig E. Wiest, Land Manager, Western US, for Carrizo Oil and Gas, Inc.

Witness my hand and official seal.  
[SEAL]

My commission expires: 3/5/2016

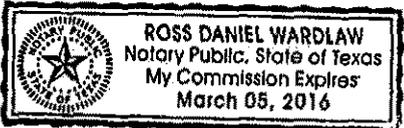
  
Notary Public

EXHIBIT 1

Weld County, Colorado  
T9N-R59W Sec 36

<b>10N 60W</b>		31	<b>10N 59W</b>		33	34									
2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5
11	12	7	8	9	10	11	12	7	8	9	10	11	12	7	8
14	13	18	17	16	15	14	13	18	17	16	15	14	13	18	17
<b>9N 60W</b>			<b>9N 59W</b>						<b>9N 58W</b>				<b>9N 57W</b>		
23	24	19	20	21	22	23	24	19	20	21	22	23	24	19	20
26	25	30	29	28	27	26	25	30	29	28	27	26	25	30	29
35	36	31	32	33	34	35	36	31	32	33	34	35	36	31	32
2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5
11	12	7	8	9	10	11	12	7	8	9	10	11	12	7	8
<b>8N 60W</b>			<b>8N 59W</b>						<b>8N 58W</b>				<b>8N 57W</b>		
14	13	18	17	16	15	14	13	18	17	16	15	14	13	18	17
23	24	19	20	21	22	23	24	19	20	21	22	23	24	19	20
26	25	30	29	28	27	26	25	30	29	28	27	26	25	30	29

# Paul Fears

## Geoscience Testimony

Colorado Oil and Gas Conversation Commission Hearing  
Cause No. 535  
Docket No. 1309-AW-54

Township 9 North, Range 59 West, 6<sup>th</sup> P.M., section 36

Weld County, Colorado

My name is Paul Fears. I am currently employed as the DJ Basin Geologist for Carrizo Oil and Gas Incorporated (Carrizo). I have a Bachelors of Science in Geology from Northern Arizona University. I have experience in oil and gas exploration and development throughout North America.

In support of Carrizo's application, I am submitting five exhibits. These exhibits are attached to my sworn testimony and outline the parameters for this application to increase the density of up to sixteen horizontal wells within the identified 640-acre drilling and spacing units.

Exhibit No. G1:            Spacing Locator Map

Exhibit No. G1 displays the drilling and spacing units Carrizo is requesting consideration for approval from the Oil and Gas Conservation Commission to increase the density of drilling. The area is section 36, township 9 north, range 59 west, in Weld County, Colorado. This area is represented on the map as a blue-filled rectangle. The location of the type-log well on Exhibit G2 is identified as the blue circle near the center of the map. The location of the cross-section line found on Exhibit G3 is displayed as a blue line on this exhibit. Wells with Niobrara production are identified with yellow circles.

Exhibit No. G2:            Niobrara Type Log

Exhibit No. G2 is the Type Log used for this area. The log is from Polfam Exploration Company's Sievers 33-18, located in section 18, T8N R61W. Displayed on this type log are typical Gamma Ray, Resistivity, Compensated Density and Compensated Neutron porosity curves associated with modern open-hole

logging of the Niobrara in the area. Scales of each curve are posted at the top of the log. The Niobrara top is identified as the upper blue line on the log. The entire Niobrara Formation is seen on the type log as including the lower Fort Hays Limestone member. The type log exhibits resistivities and porosities similar to logs derived from Niobrara producers nearby in Weld County.

Exhibit No. G3:            Cross Section A-A'

Exhibit No. G3 is a cross-section of wells near and across the several sections which comprise the drilling and spacing units; showing the Niobrara section. The cross-section extends generally from southwest (A) to northeast (A') and is hung on the top of the Niobrara. All the logs display resistivity curves with the gamma ray or spontaneous potential. Logs on the cross-section exhibit resistivities comparable to productive Niobrara wells located in Weld County.

Exhibit No. G4:            Niobrara Gross Thickness Isopach

Exhibit G4 shows the gross thickness from the top of the Niobrara to the top of the Codell contoured in 10' increments. Thickness values are posted in green below the well symbol. In the spacing area, Niobrara thickness averages around 350'. The Niobrara Formation is shown to generally thicken towards the northwest of the map by about 50' in the mapped area. The type log is highlighted with a blue circle.

Exhibit No. G5:            Niobrara Top Subsea Structure

Exhibit No. G5 shows the top subsea structure of the Niobrara contoured in 25' increments. Niobrara top subsea values are posted in blue below the well symbol. The map reflects the regional monoclinial dip to the west existing in this area.

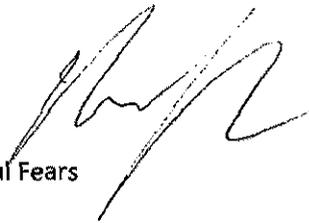
All five (5) Exhibits are intended to help illustrate:

- The Niobrara is productive in the area.
- The Niobrara is fairly uniform in thickness and is contiguous throughout the area.

The geologic attributes described above, in conjunction with the engineering testimony submitted for this hearing by Stephen C. Peters concerning the limited drainage area of producing Niobrara wells, demonstrate the viability of higher drilling densities for the Niobrara Formation in the area.

The matters described herein were all conducted under my direction and control. To the best of my knowledge, all of the matters set forth herein, my testimony and exhibits, are true, correct and accurate.

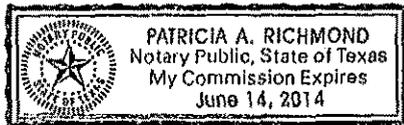
Dated this 29<sup>th</sup> day of August, 2013.



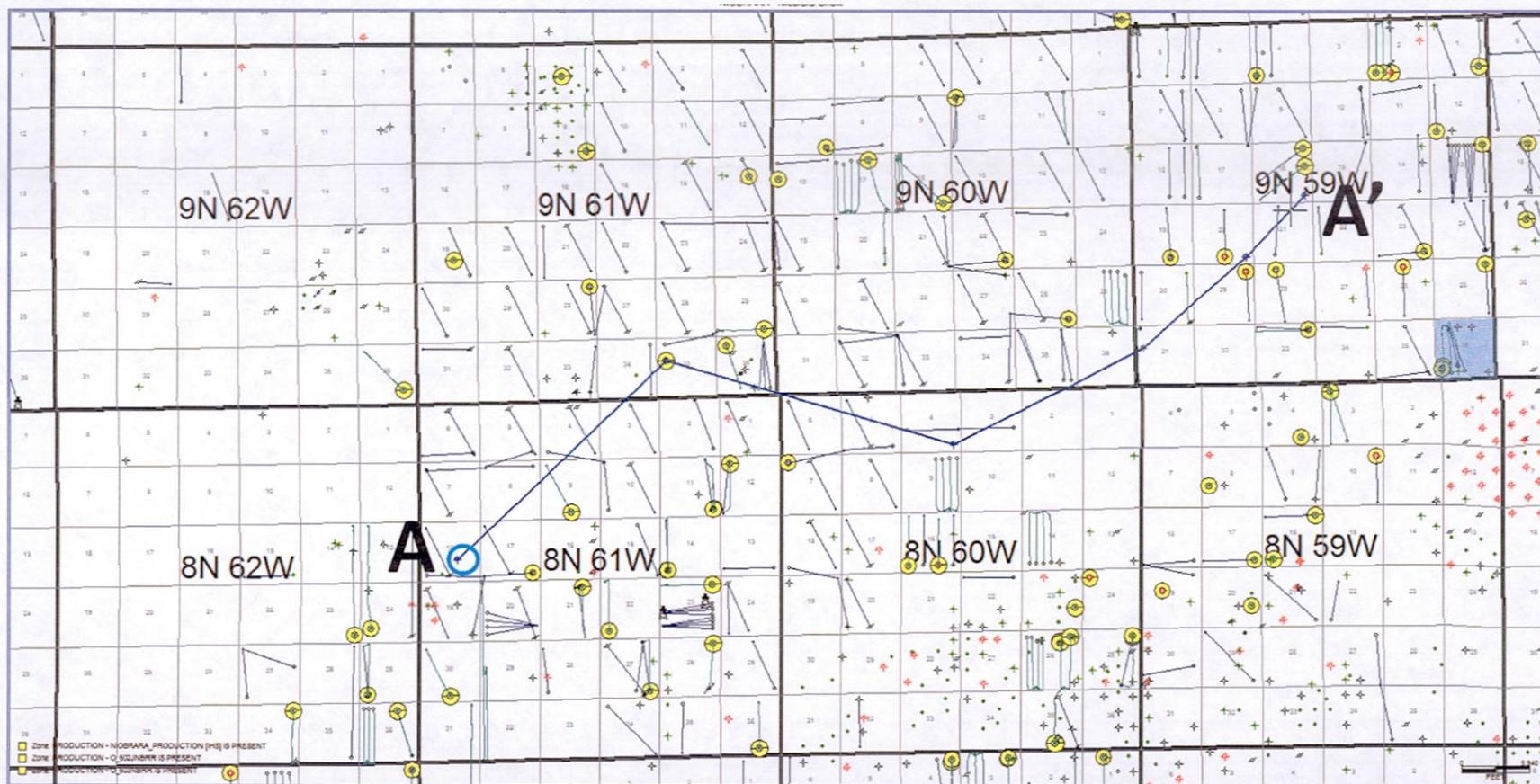
Paul Fears

STATE OF TEXAS           §  
  §  
COUNTY OF HARRIS       §

This instrument was acknowledged, sworn to and subscribed before me on August 30 2013, by Paul Fears – Geologist, Carrizo Oil & Gas, Inc., a Texas corporation, on behalf of said corporation.



Patricia A. Richmond  
Notary Public  
State of Texas



CARRIZO OIL & GAS, INC

Information Base Map - reported Niobrara production indicated with yellow circle ●

Type log indicated with blue circle ○

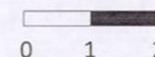
Proposed Units Highlighted in Blue

Weld County, Colorado

Cause No. 535; Docket No. 1309-AW-54

**Exhibit G1**

Scale in miles



**CARRIZO OIL & GAS, INC**

**Type Log**

05123189670000

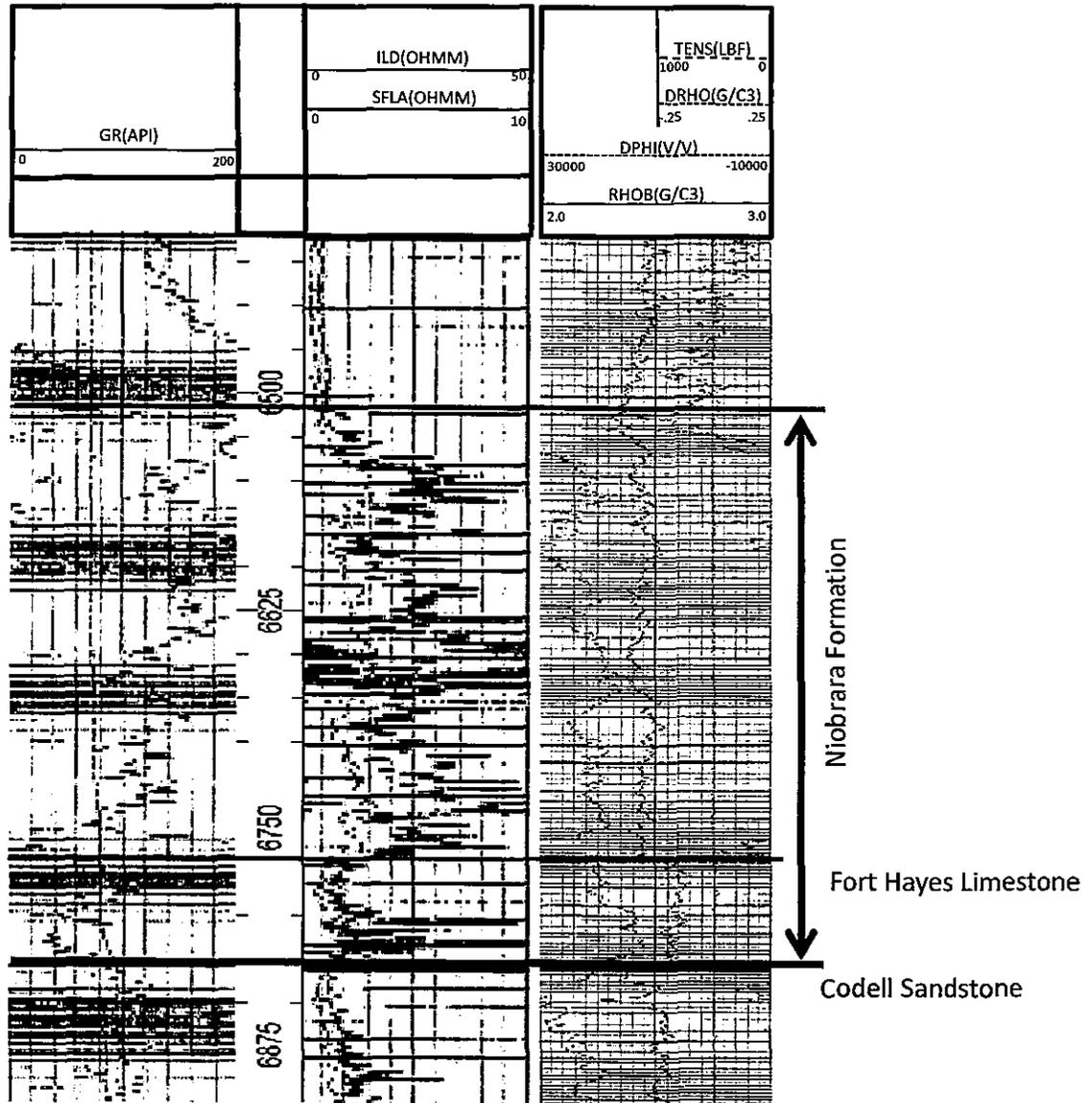
Polfam Exploration Company

Sievers 33-18

Sec. 18

TwN 8N Rng 61W

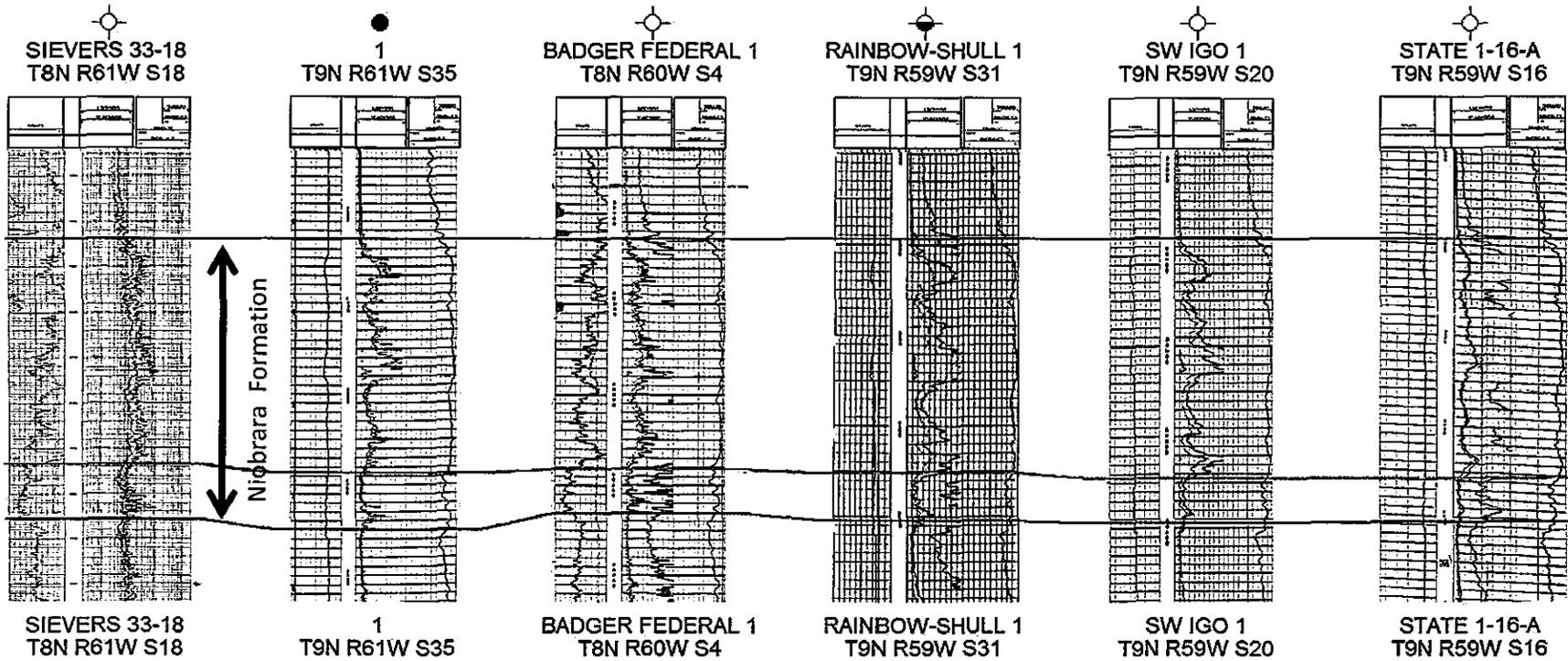
Cause No. 535; Docket No. 1309-AW-54



**Exhibit G2**

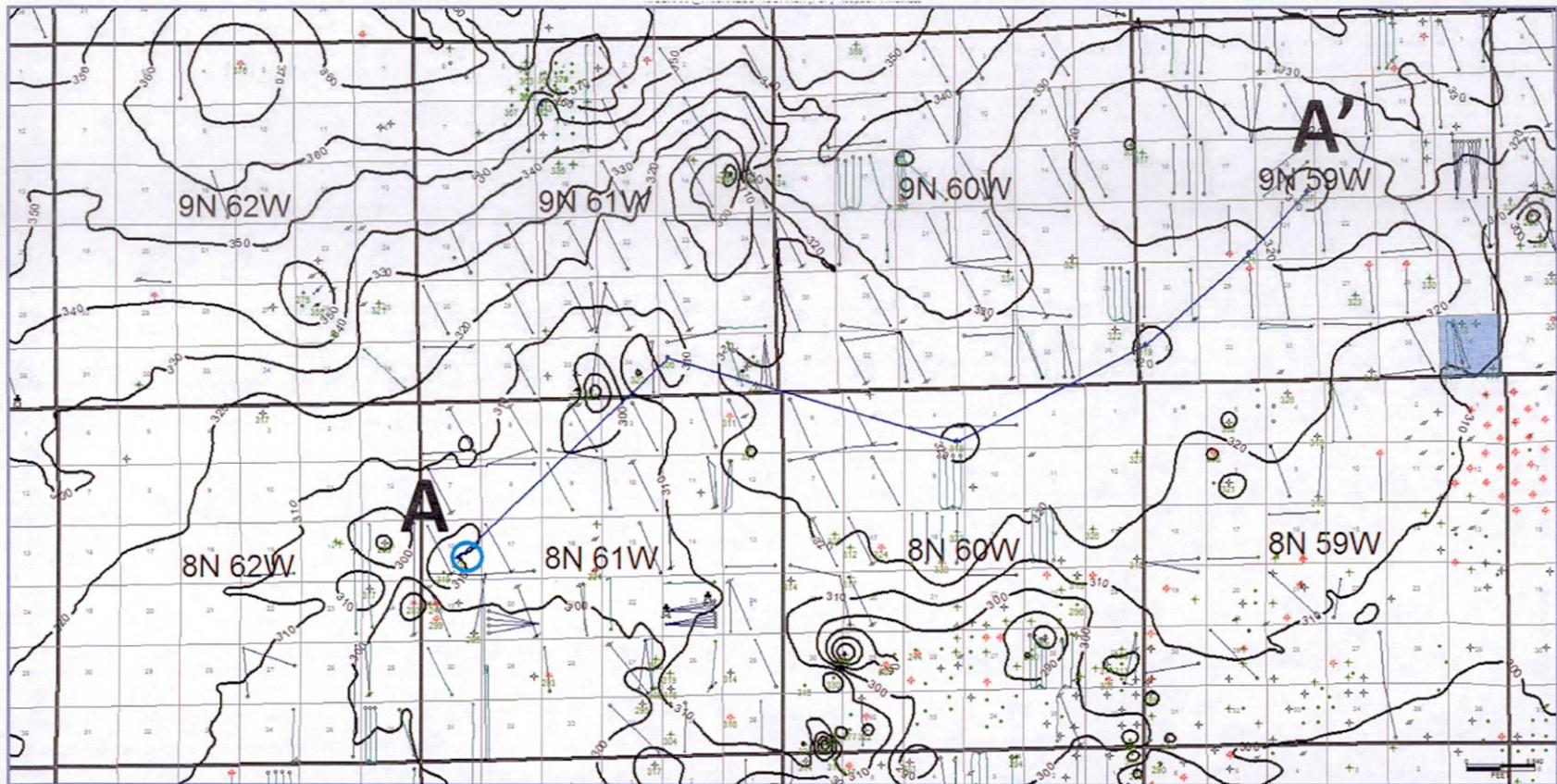
A

A'



CARRIZO OIL & GAS, INC  
Stratigraphic Cross Section  
Hung on the Top of Niobrara  
Cause No. 535; Docket No. 1309-AW-54

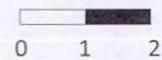
Exhibit G3

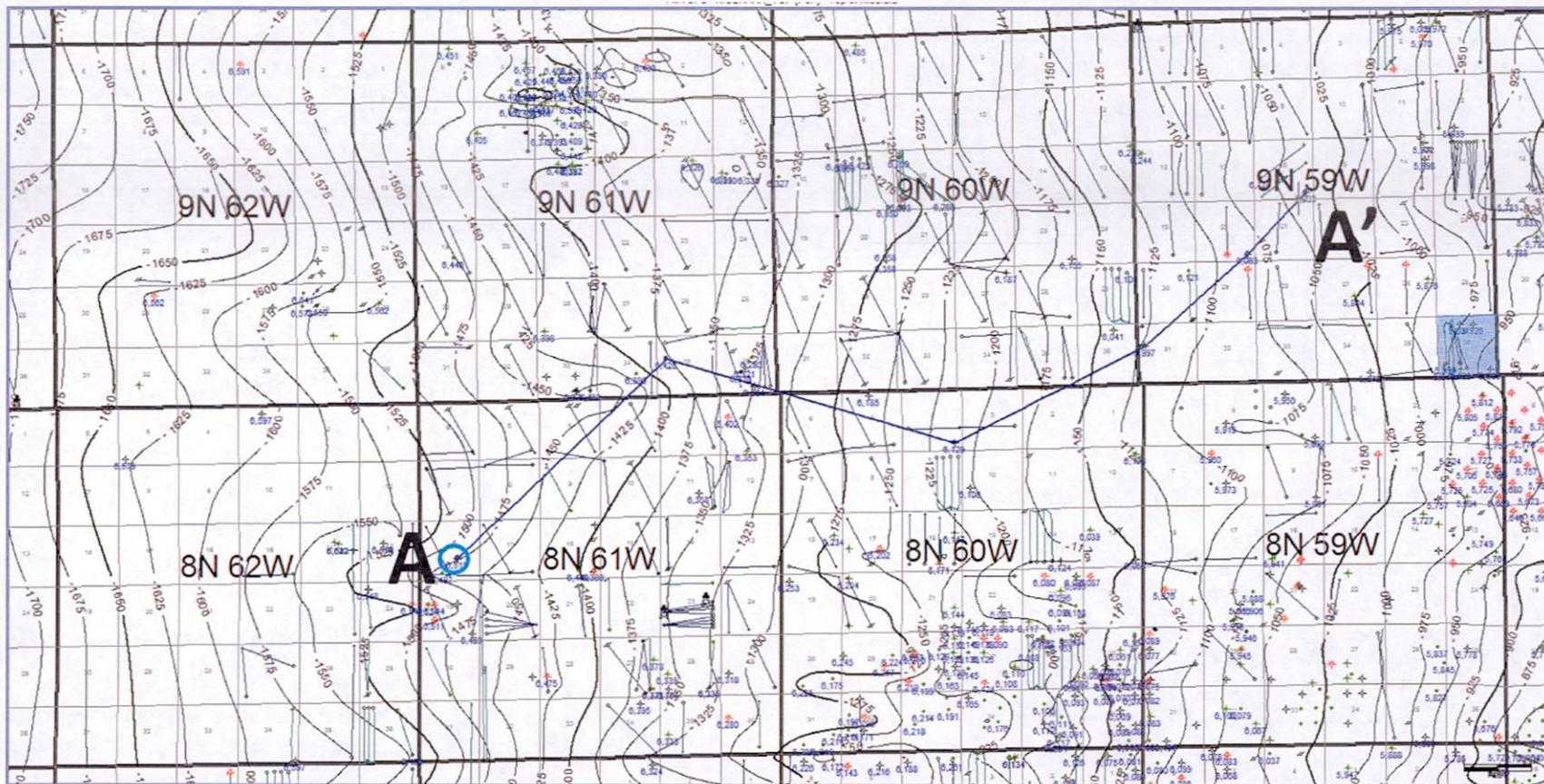


CARRIZO OIL & GAS, INC  
 Niobrara Isopach Map - 10' Contour Interval  
 Type log indicated with blue circle  
 Proposed units highlighted in blue   
 Weld County, Colorado  
 Cause No. 535; Docket No. 1309-AW-54

**Exhibit G4**

Scale in miles

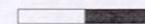




CARRIZO OIL & GAS, INC  
 Niobrara Structure Top Map (Subsea TVD) - 25' Contour Interval  
 Type log indicated with blue circle   
 Proposed Units Highlighted in Blue  
 Weld County, Colorado  
 Cause No. 535; Docket No. 1309-AW-54

**Exhibit G5**

Scale in miles



0 1 2

Engineering Testimony—Stephen C. Peters  
Unnamed Field  
Cause No. 535; Docket No. 1309-AW-54  
Spacing Application  
Niobrara Formation

September 16, 2013 Colorado Oil and Gas Conservation Commission Hearing

My name is Stephen C. Peters, and I am currently employed as Manager of Reservoir Engineering for Carrizo Oil & Gas, Inc. (“Carrizo”). I graduated from The University of Texas at Austin in 1974 with a degree in Mathematics. I have over 37 years of experience in drilling and completion, production operations, and reservoir evaluation. A copy of my curriculum vitae is attached to this submittal and marked as Exhibit E-1. I am familiar with the lands that are subject of this matter.

In support of Carrizo’s application today, seven (7) exhibits are submitted. The exhibits are attached to my sworn testimony and form the basis for the above-referenced application (“Application”) for an order approving a drilling unit with the following specifications. The Application requests 16 wellbores per 640 acre unit – maintaining 300’ offsets to sideline unit boundaries - or per one mile unit width perpendicular to the laterals for units of less or more than 640 acres. For purposes of this analysis, 300’ internal wellbore setbacks are used as a modeling convention. The requested unit is for development of and production from the Niobrara Formation, in the following lands:

Township 9 North, Range 59 West, 6<sup>th</sup> P.M.  
Section 36: All

Weld County, Colorado;

**Exhibit No. E-1** is a copy of my resume/curriculum vitae.

**Exhibit No. E-2** presents anticipated initial formation pressure determined from analysis of a leak-off test performed in Carrizo’s State 36-24-9-61H well. This well is one of two Carrizo wells in which such testing has been performed.

**Exhibit No. E-3** presents anticipated initial formation pressure from the second well in which leak-off testing has been performed, Carrizo’s Bob White 36-44-8-62H.

**Exhibit No. E-4** is a rate-pressure transient analysis (or RTA) which presents historical bottom hole flowing pressures (calculated from corresponding surface pressures) compared to modeled bottom hole flowing pressures in the Carrizo State 36-24-9-61H well. The model incorporates actual rate history and the initial reservoir pressure determined from evaluation of the leak-off test along with the actual completed length of this well and frac half-lengths of 75’.

**Exhibit No. E-5** is a rate-pressure transient analysis which presents historical bottom hole flowing pressures compared to modeled bottom hole flowing pressures in the Carrizo Bob White 36-44-8-62H well. The model incorporates actual rate history and the initial reservoir pressure determined from evaluation of the leak-off test along with the actual completed length of this well and frac half-lengths of 75'.

**Exhibit No. E-6** presents specific calculations for two example wells with reservoir properties equal to those observed in Carrizo's State 36-24-9-61H and Carrizo's Bob White 36-44-8-62H but with lateral lengths and drainage widths adjusted to accommodate the proposed spacing dimensions. The anticipated EUR for each of these two example wells was determined by RTA modeling and forecasting. The same reservoir permeability and frac half-lengths which resulted from matching the rate-pressure histories of the two wells (referenced in Exhibits E-4 and E-5) were used in modeling the example wells and the number of frac stages were adjusted to accommodate the revised lateral lengths.

**Exhibit E-7** presents results of economic analyses of the two example wells.

**Findings from engineering analyses of information presented in the attached exhibits are summarized below:**

- Carrizo's State 36-24-9-61H well appears to have been completed in a reservoir with initial pressure of 2912 psia and average effective matrix permeability of 0.60 micro-darcies. The completed lateral length of this wellbore is 3245' incorporating 11 frac stages with apparent half-lengths of 75'. A well with a completed lateral length of 4680' incorporating 15 fracs with 75' half-lengths placed in a similar reservoir and limited to 300' internal spacing should exhibit an Estimated Ultimate Recovery (EUR) of 125.4 thousand oilfield barrels of oil (MBO) plus associated gas and processed natural gas liquids (NGL's). Economics for such a well are sound.
- Carrizo's Bob White 36-44-8-62H well appears to have been completed in a reservoir with initial pressure of 3259 psia and average effective matrix permeability of 0.30 micro-darcies. The completed lateral length of this wellbore is 3484' incorporating 14 frac stages with apparent half-lengths of 75'. A well with a completed lateral length of 4680' incorporating 15 fracs with 75' half-lengths placed in a similar reservoir and limited to 300' internal spacing should exhibit an Estimated Ultimate Recovery (EUR) of 117.9 thousand oilfield barrels of oil (MBO) plus associated gas and processed natural gas liquids (NGL's). Economics for such a well are sound.



STEPHEN C. PETERS  
Carrizo Oil & Gas, Inc.  
500 Dallas Street, Suite 2300, Houston, TX 77002  
(713) 328-1000

EXHIBIT E-1 (CURRICULUM VITAE)

1996-Present: Manager of Reservoir Engineering  
Carrizo Oil & Gas, Inc.

- Reservoir engineer for Gulf Coast, East Texas, Rocky Mountains and Eastern US areas - Carrizo Oil & Gas, Inc.
- Work with third party engineering firms in formulation of SEC year-end reports and periodic updates as needed.
  - Organize and maintain reserve portfolios in ARIES database. Perform volumetric and material balance calculations (with dynamic modeling) as back-up for reserve assignments.
  - Evaluate (for participation elections) majority of proposed work on outside operated properties.
  - Work closely with CFO and Bankers in generating loan basis for Senior Debt.
  - Work closely with Operations Department in evaluating candidates for stimulation, compression, acceleration and/or plugging.
  - Work closely with Exploration and Operations Departments in evaluating drilling prospects and acquisitions.

1995-1996: Senior Petroleum Engineer  
Pennzoil, Offshore Division, Houston, Texas

Headed Asset Team charged with expediting development projects for offshore properties located in the western Gulf of Mexico.

1992-1994: Senior Petroleum Engineer  
Pennzoil, South Texas Division, Houston, Texas

Served as chief engineer for 6 company operated oil and gas fields located in Aransas, Refugio and Victoria Counties, Texas. Directly involved with production and development operations.

1990-1991: Senior Petroleum Engineer  
Pennzoil, Western Division, Houston, Texas

Served as Joint Interest Coordinator for Western Division. Expedited approvals for expenditure (AFE's), reviewed joint venture invoices and approved for payment, interpreted gas balancing agreements and gas processing agreements, administered Joint Operating Agreements, and represented company in communications with joint interest owners.

1985-1989: Senior Petroleum Engineer  
Proven Properties Inc., Houston, Texas (Acquisitions Company Partially Owned by Pennzoil)

Evaluated reserves, prepared estimates of future cash flows and assigned bid values to producing oil and gas properties designated as purchase candidates.

1979-1984: Supervisory Petroleum Engineer  
Pennzoil, Offshore Division, Houston, Texas

Served as field engineer for 5 company operated and 4 non-operated offshore fields in western Gulf of Mexico. Earned promotion to Supervisory Engineer and exercised staff authority over 5 field engineers in Pennzoil's Houston Marine District.

1976-1978: Drilling Engineer  
Pennzoil, Offshore Division, Houston, Texas

Served as on-site supervisor for drilling, completion and workover operations on offshore wells, western Gulf of Mexico.

1975: Mud Engineer/Mud Logger  
IMCO Services, Houston, Texas

Served as on-site drilling fluids specialist on wells in Gulf of Mexico, Abu Dhabi and North Slope Alaska.

EDUCATION and MEMBERSHIPS

B.A. Mathematics (High Honors)-The University of Texas at Austin-January 1975

26 Year Member - Society of Petroleum Engineers

Exhibit E-2

**Carrizo State 36-24-9-61 H**  
**P\* from Fall-Off**

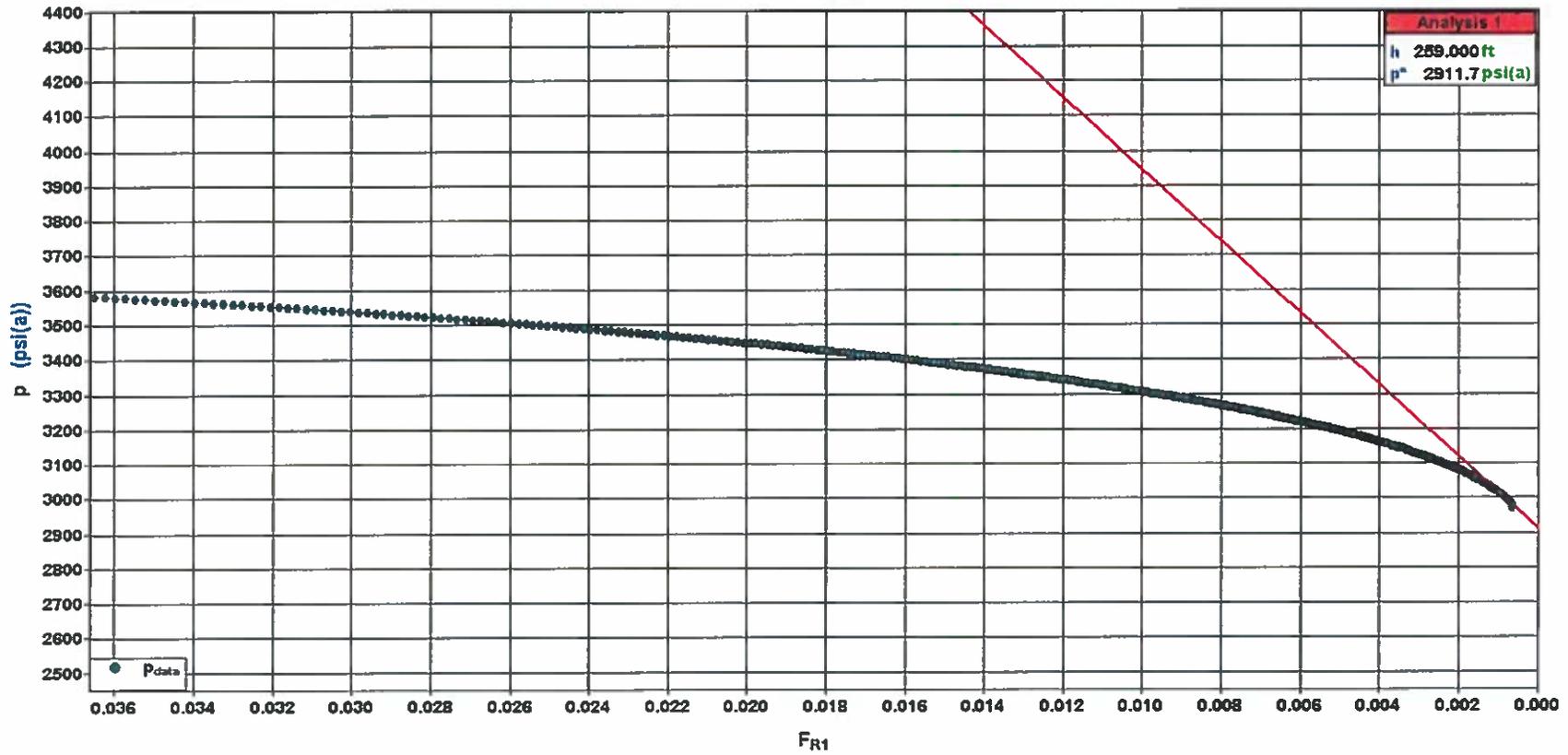


Exhibit E-3

**Carrizo Bob White 36-44-8-62 H**  
**P\* from Fall-Off**

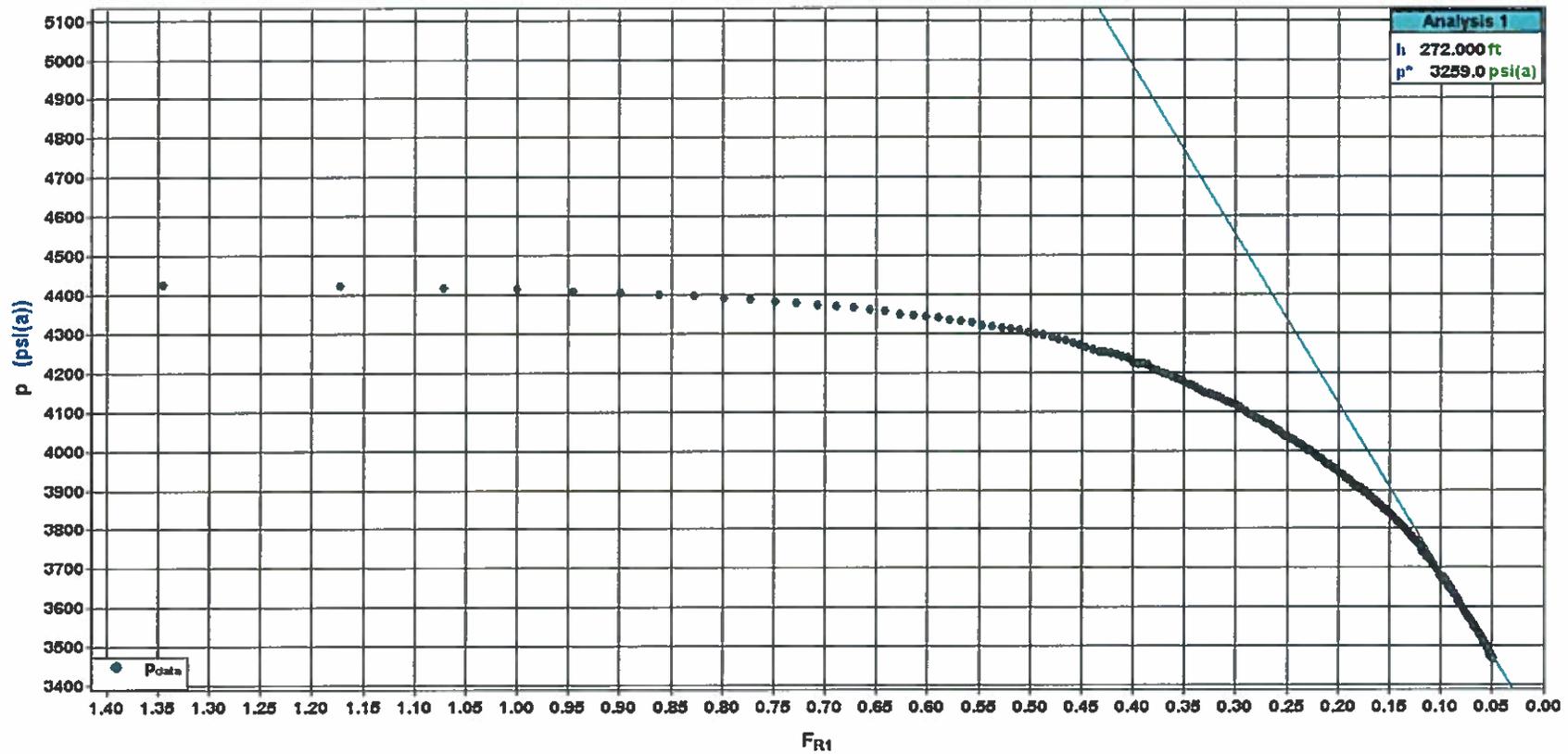


Exhibit E-4

State 36-24-9-61 H Multifrac-Composite Model  
3245' Lateral, Xf = 75' w/ 0.60 micro-darcies Perm

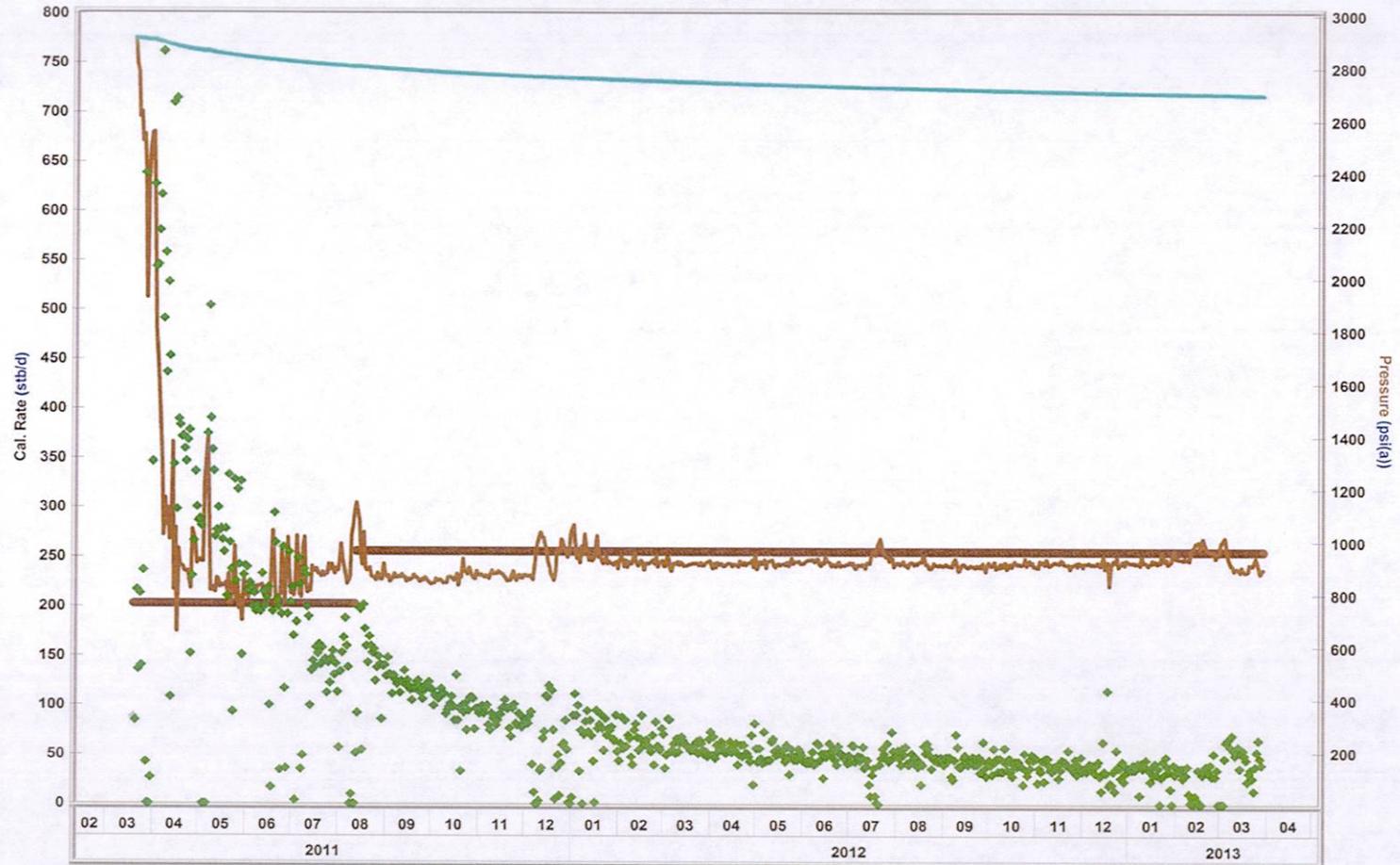
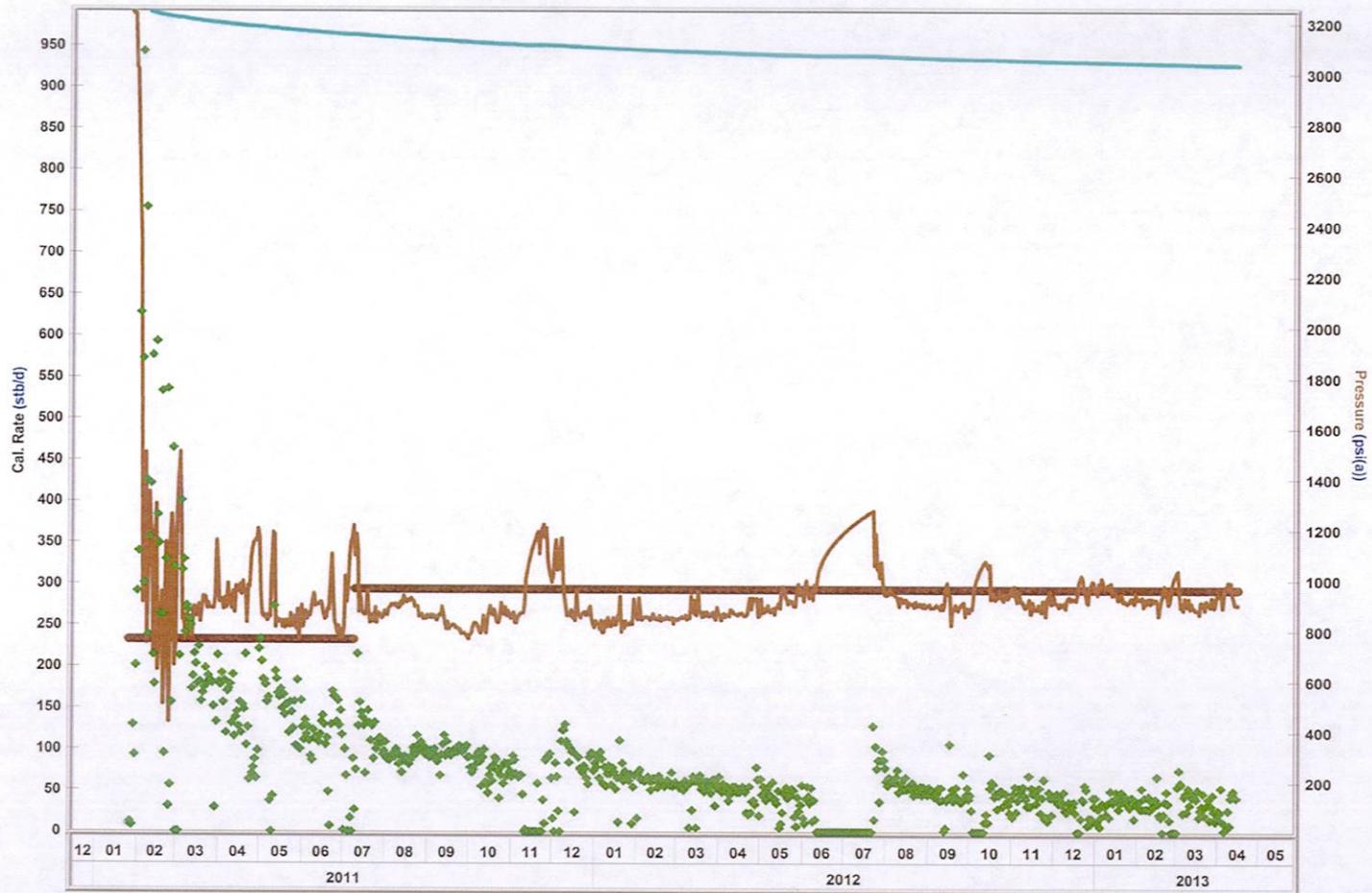


Exhibit E-5

Bob White 36-44-8-62 H Multifrac-Composite Model  
3415' Lateral, Xf = 75' w/ 0.30 micro-darcies Perm



**Exhibit E-6**

**Carrizo Oil & Gas, Inc. - Volumetric Oil Reserve Worksheet**

**Example Well Based on Properties Identified in Carrizo State 36-24-9-61H**

Description of Parameter	Value of Parameter
Depth (TVD below Ground Level)	6,350
Porosity	8.03%
Sw (Water Saturation-Percent of Pore Space)	60.00%
Height (Thickness) of Formation	259
Initial Reservoir Pressure (PSIA)	2,912
Initial Reservoir Temperature (degF)	217
Initial Gas-Oil Ratio (CuF/Stock Tank Bbl)	650
Oil Gravity (deg API)	38.0
Sep Gas Gravity (air = 1.0)	0.88
Formation Volume Factor (Reservoir Bbls/Stock Tank Bbl)	1.374
Lateral Section Drained (Ft) = Length of Completed Horizontal Wellbore	4,680
Width of Drainage (Ft) = Spacing Distance Between Wellbores	300
Acres in Drained Area	32.2
Original Stock Tank Oil in Place (Mbbbls) per Spacing Unit assuming uniform Height	1,514.0
<b>Modeled EUR to Economic Operating Limit (MBbls)</b>	<b>125.4</b>
Anticipated Recovery Efficiency at Stipulated Spacing	8.3%

**Example Well Based on Properties Identified in Carrizo Bob White 36-44-8-62H**

Description of Parameter	Value of Parameter
Depth (TVD below Ground Level)	6,600
Porosity	6.04%
Sw (Water Saturation-Percent of Pore Space)	57.00%
Height (Thickness) of Formation	272
Initial Reservoir Pressure (PSIA)	3,259
Initial Reservoir Temperature (degF)	218
Initial Gas-Oil Ratio (CuF/Stock Tank Bbl)	900
Oil Gravity (deg API)	38.0
Sep Gas Gravity (air = 1.0)	0.88
Formation Volume Factor (Reservoir Bbls/Stock Tank Bbl)	1.497
Lateral Section Drained (Ft) = Length of Completed Horizontal Wellbore	4,680
Width of Drainage (Ft) = Spacing Distance Between Wellbores	300
Acres in Drained Area	32.2
Original Stock Tank Oil in Place (Mbbbls) per Spacing Unit assuming uniform Height	1,180.0
<b>Modeled EUR to Economic Operating Limit (MBbls)</b>	<b>117.9</b>
Anticipated Recovery Efficiency at Stipulated Spacing	10.0%

Exhibit E-7

**Niobrara Formation Drilling & Spacing Unit Application**

**Economic Calculations-Example Wells With 300' Internal Offsets**

	CAPEX \$/M	Oil Price \$/Bbl (NYMEX)	Gas Price \$/MCF (NYMEX)	Oil EUR MBbl	Gas EUR MMCF	NPV <sub>10</sub> BFIT \$M	DCFROR %	Disc ROI	Discounted Payout (Yrs)
<b>Well Based on State 36-24-6-61H Properties</b>									
Unrisked:	\$4,200.0	\$90.00	\$4.00	125.4	86.2	\$2,664.0	104.2%	1.64	1.05
<b>Well Based on Bob White 36-44-8-62H Properties</b>									
Unrisked:	\$4,200.0	\$90.00	\$4.00	117.9	113.6	\$2,068.2	54.2%	1.49	1.62

**Key Assumptions**

Operating Expenses \$5,600/Month plus \$1.98/Bbl  
WI = 100.000%, Royalty = 18.000%, NRI = 82.000%

The economics for these projects are sound.



# *CARRIZO OIL & GAS, INC.*

**RECEIVED**  
OCT 24 2013  
**COGCC**

ORIGINAL

AMENDED AND RESTATED

Cause No. 535

Docket No. 1309-AW-54

Land Testimony – Ross D. Wardlaw  
Unnamed Field  
Cause No. 535; Docket No. 1309-AW-54  
Increased Density Application  
Niobrara Formation

October 2013 Colorado Oil and Gas Conservation Commission Hearing

My name is Ross D. Wardlaw, and I am currently Senior Landman for Carrizo Oil and Gas, Inc. (“Carrizo”). I have over seven (7) years of experience as a landman and have been employed since 2008 with Carrizo and have worked directly with the properties that are subject of this matter.

In support of Carrizo’s application today, I have prepared one exhibit. The exhibit is attached to my sworn testimony and forms the basis for the above-referenced application (“Application”) which requests an order to allow up to fifteen horizontal wells in an approximate 640-acre drilling and spacing unit in the following-described lands:

Township 9 North, Range 59 West, 6<sup>th</sup> P.M.  
Section 36: All

Weld County, Colorado (hereafter “Application Lands”).

The Application also requests that internal wellbores be offset by 300 feet and unit boundary setbacks of 300 feet on the north and west unit boundary lines, while maintaining setbacks of 600 feet on the east and south unit boundary lines.

1. Exhibit No. 1

Exhibit No. 1 is a Plat that shows the Application Lands.

I certify that Carrizo is an owner with the right to drill wells in the subject unit by virtue of its leasehold interests, and is therefore qualified to apply for the requested relief pursuant to C.R.S. 34-60-116 and Rule 507(b)(1) and (4). All of the other owners in the proposed unit that were known to Carrizo (and who could be located) at the time that this application was filed with the Commission received notice of thereof at least twenty (20) days prior to the hearing on this matter. As of the date of this testimony, no timely protest has been filed in this matter.

The matters described herein were all conducted under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and in the exhibits are true, correct, and accurate.



# Paul Fears

## Geoscience Testimony

Colorado Oil and Gas Conversation Commission Hearing  
Cause No. 535  
Docket No. 1309-AW-54

Township 9 North, Range 59 West, 6<sup>th</sup> P.M., section 36

Weld County, Colorado

My name is Paul Fears. I am currently employed as the DJ Basin Geologist for Carrizo Oil and Gas Incorporated (Carrizo). I have a Bachelors of Science in Geology from Northern Arizona University. I have experience in oil and gas exploration and development throughout North America.

In support of Carrizo's application, I am submitting five exhibits. These exhibits are attached to my sworn testimony and outline the parameters for this application to increase the density of up to fifteen horizontal wells within the identified 640-acre drilling and spacing unit, and maintain the requested 300' setbacks on the north and west section lines, while increasing the setbacks to 600' on the east and south section lines.

Exhibit No. G1:            Spacing Locator Map

Exhibit No. G1 displays the drilling and spacing units Carrizo is requesting consideration for approval from the Oil and Gas Conversation Commission to increase the density of drilling. The area is section 36, township 9 north, range 59 west, in Weld County, Colorado. This area is represented on the map as a blue-filled rectangle. The location of the type-log well on Exhibit G2 is identified as the blue circle near the center of the map. The location of the cross-section line found on Exhibit G3 is displayed as a blue line on this exhibit. Wells with Niobrara production are identified with yellow circles.

Exhibit No. G2:            Niobrara Type Log

Exhibit No. G2 is the Type Log used for this area. The log is from Polfam Exploration Company's Sievers 33-18, located in section 18, T8N R61W. Displayed on this type log are typical Gamma Ray, Resistivity, Compensated Density and Compensated Neutron porosity curves associated with modern open-hole logging of the Niobrara in the area. Scales of each curve are posted at the top of the log. The Niobrara top is identified as the upper blue line on the log. The entire Niobrara Formation is seen on the type log as including the lower Fort Hays Limestone member. The type log exhibits resistivities and porosities similar to logs derived from Niobrara producers nearby in Weld County.

Exhibit No. G3:            Cross Section A-A'

Exhibit No. G3 is a cross-section of wells near and across the several sections which comprise the drilling and spacing units; showing the Niobrara section. The cross-section extends generally from southwest (A) to northeast (A') and is hung on the top of the Niobrara. All the logs display resistivity curves with the gamma ray or spontaneous potential. Logs on the cross-section exhibit resistivities comparable to productive Niobrara wells located in Weld County.

Exhibit No. G4:            Niobrara Gross Thickness Isopach

Exhibit G4 shows the gross thickness from the top of the Niobrara to the top of the Codell contoured in 10' increments. Thickness values are posted in green below the well symbol. In the spacing area, Niobrara thickness averages around 350'. The Niobrara Formation is shown to generally thicken towards the northwest of the map by about 50' in the mapped area. The type log is highlighted with a blue circle.

Exhibit No. G5:            Niobrara Top Subsea Structure

Exhibit No. G5 shows the top subsea structure of the Niobrara contoured in 25' increments. Niobrara top subsea values are posted in blue below the well symbol. The map reflects the regional monoclinial dip to the west existing in this area.

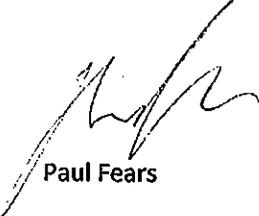
All five (5) Exhibits are intended to help illustrate:

- The Niobrara is productive in the area.
- The Niobrara is fairly uniform in thickness and is contiguous throughout the area.

The geologic attributes described above, in conjunction with the engineering testimony submitted for this hearing by Stephen C. Peters concerning the limited drainage area of producing Niobrara wells, demonstrate the viability of higher drilling densities for the Niobrara Formation in the area.

The matters described herein were all conducted under my direction and control. To the best of my knowledge, all of the matters set forth herein, my testimony and exhibits, are true, correct and accurate.

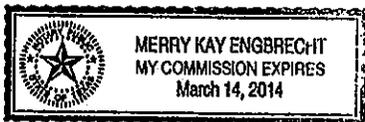
Dated this 24<sup>th</sup> day of October, 2013.



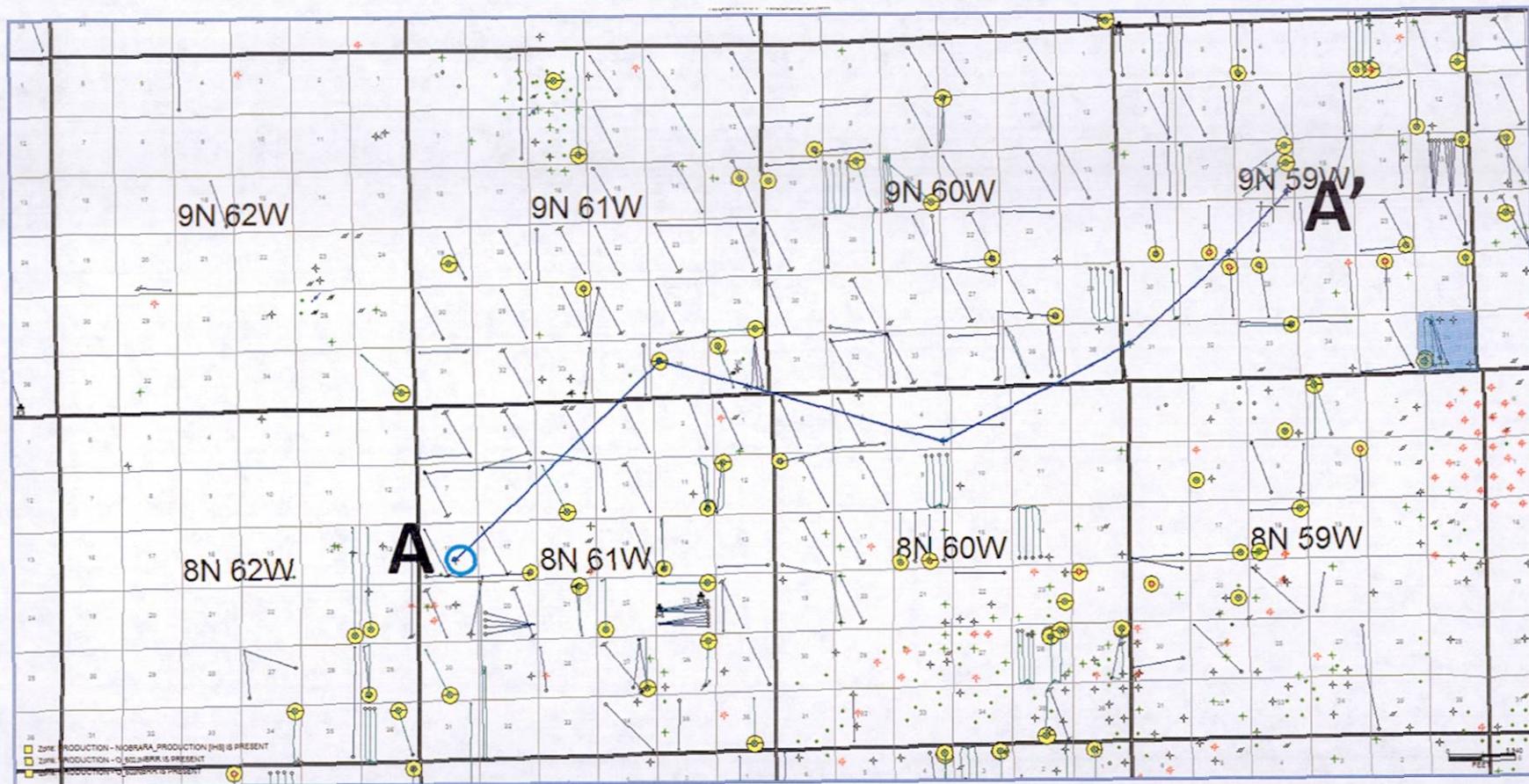
Paul Fears

STATE OF TEXAS           §  
  §  
COUNTY OF HARRIS       §

This instrument was acknowledged, sworn to and subscribed before me on October 24, 2013, by Paul Fears – Geologist, Carrizo Oil & Gas, Inc., a Texas corporation, on behalf of said corporation.



  
~~Patricia A. Richmond~~ Merry Kay Engbrecht  
Notary Public  
State of Texas



CARRIZO OIL & GAS, INC

Information Base Map - reported Niobrara production indicated with yellow circle 

Type log indicated with blue circle 

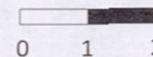
Proposed Units Highlighted in Blue

Weld County, Colorado

Cause No. 535; Docket No. 1309-AW-54

**Exhibit G1**

Scale in miles



**CARRIZO OIL & GAS, INC**

**Type Log**

05123189670000

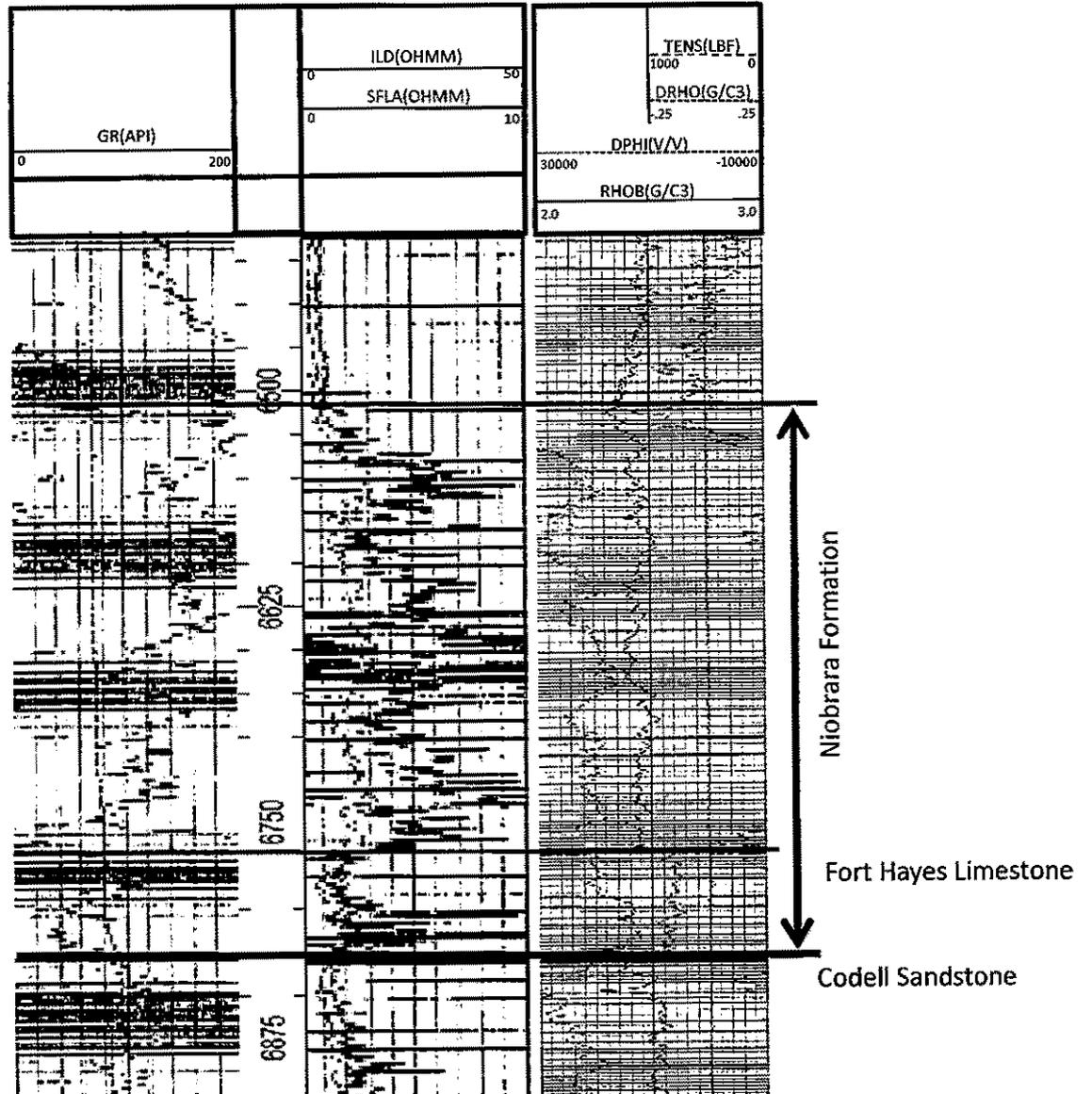
Polfam Exploration Company

Sievers 33-18

Sec. 18

TwN 8N Rng 61W

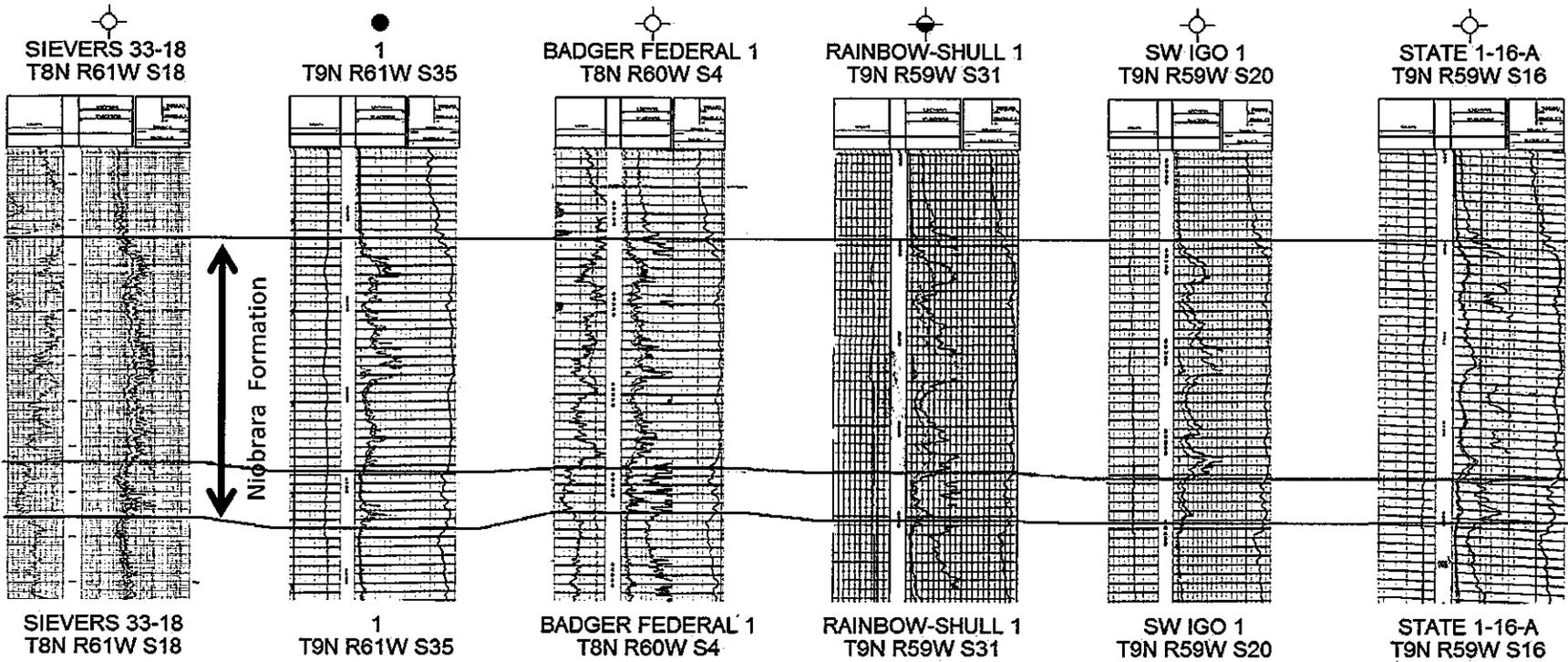
Cause No. 535; Docket No. 1309-AW-54



**Exhibit G2**

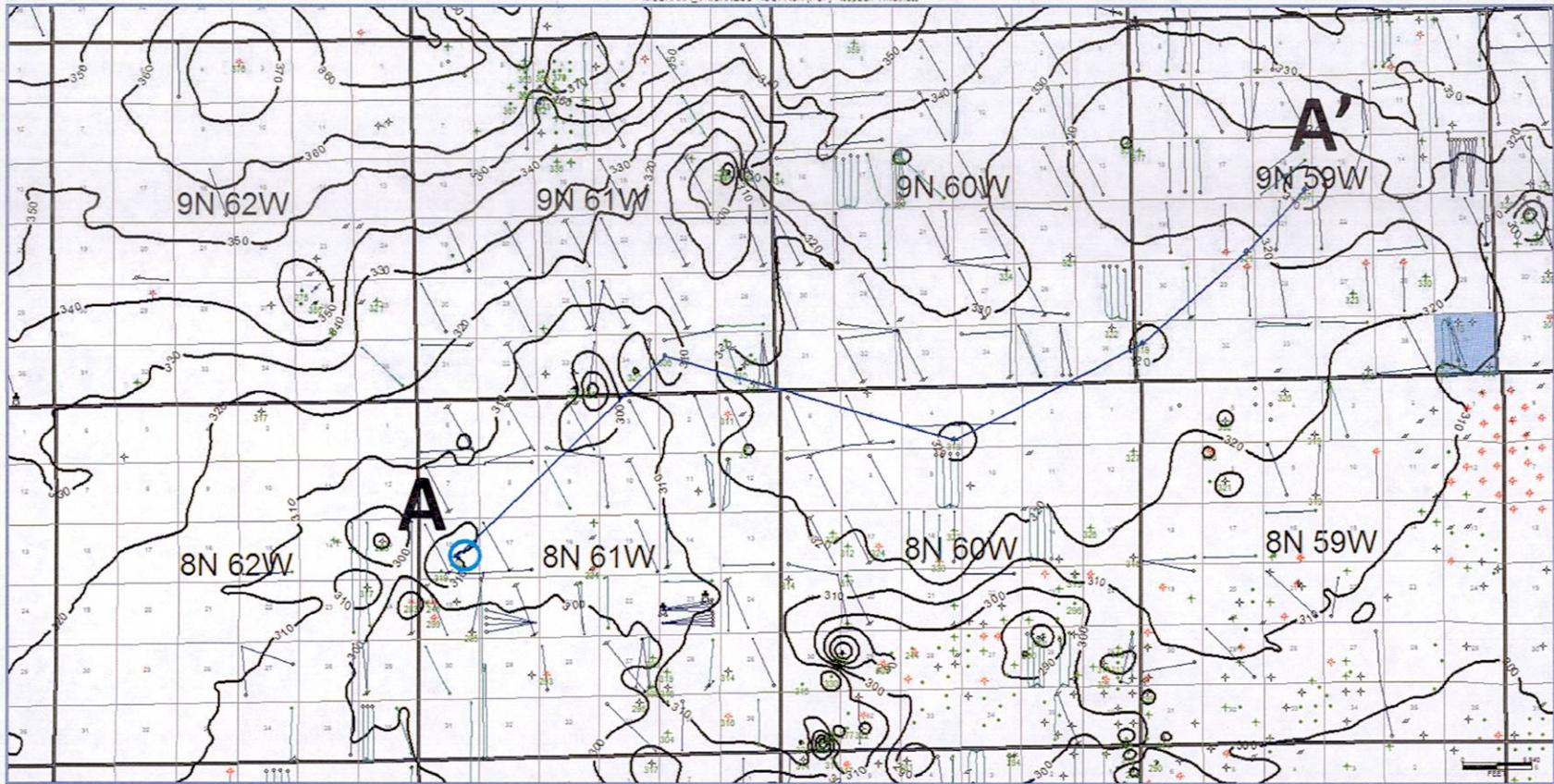
A

A'



CARRIZO OIL & GAS, INC  
Stratigraphic Cross Section  
Hung on the Top of Niobrara  
Cause No. 535; Docket No. 1309-AW-54

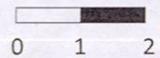
Exhibit G3

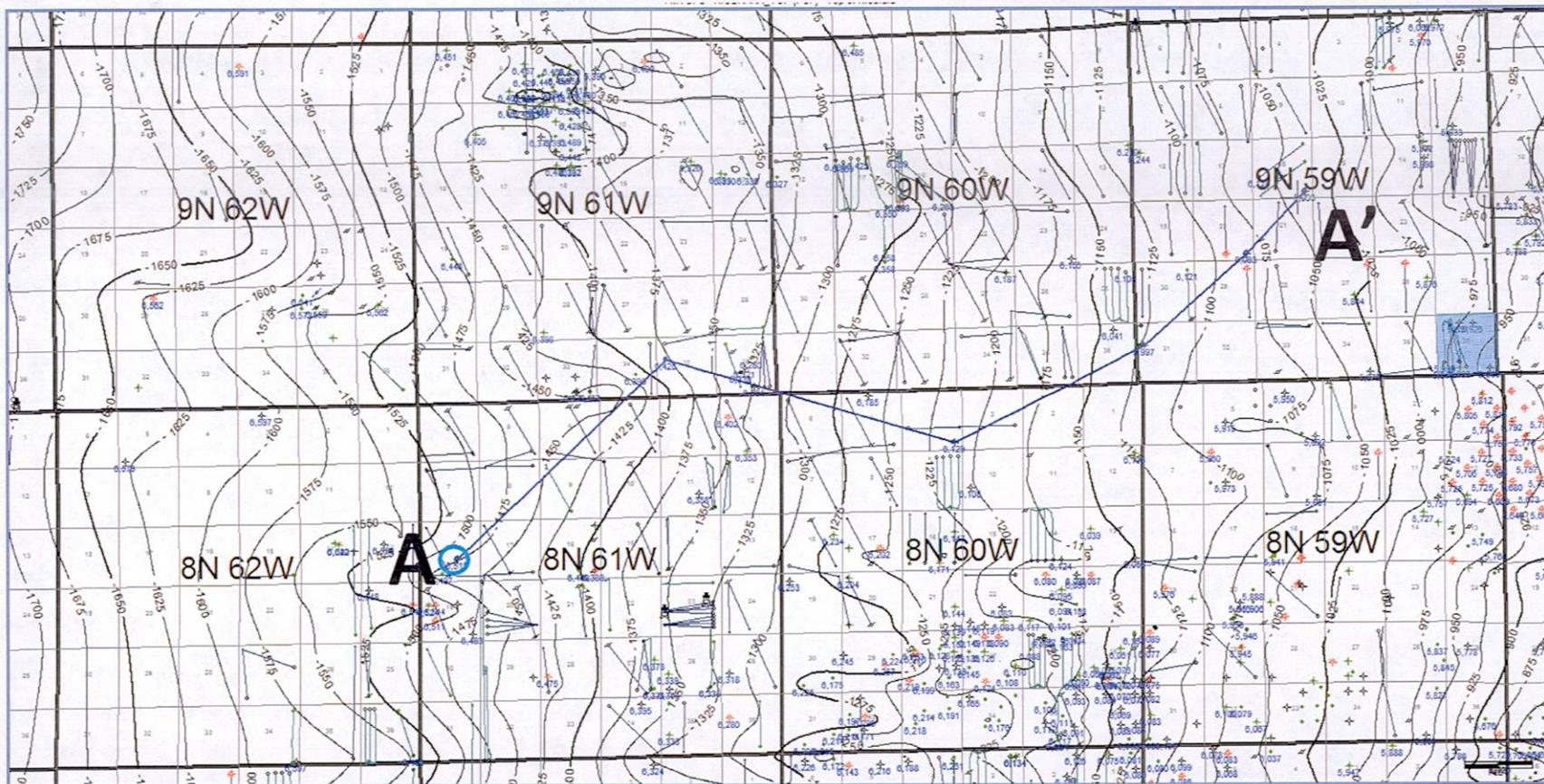


CARRIZO OIL & GAS, INC  
 Niobrara Isopach Map - 10' Contour Interval  
 Type log indicated with blue circle  
 Proposed units highlighted in blue   
 Weld County, Colorado  
 Cause No. 535; Docket No. 1309-AW-54

**Exhibit G4**

Scale in miles

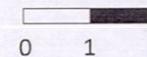




CARRIZO OIL & GAS, INC  
 Niobrara Structure Top Map (Subsea TVD) - 25' Contour Interval  
 Type log indicated with blue circle   
 Proposed Units Highlighted in Blue  
 Weld County, Colorado  
 Cause No. 535; Docket No. 1309-AW-54

**Exhibit G5**

Scale in miles



# Paul C. Fears

[paul.fears@crzo.net](mailto:paul.fears@crzo.net)

500 Dallas St  
Houston, TX  
713-358-6224

## EXPERIENCE

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### **Geologist for Denver-Julesburg Basin, Carrizo Oil and Gas, Houston Tx.**

- Development and operations, including well planning, geosteering, and risk evaluation
- Unconventional prospect evaluation and acreage assesment
- Conventional exploration within the DJ basin
- Regional mapping and development of emerging Rocky Mountian unconventional plays

### **Contract Geologist, Encana Oil and Gas, Dallas, Texas**

- Oversaw the geosteering of up to thirteen rigs drilling in five or more plays at any one time. Provided oversight to multiple groups in various offices, including exploration, lease retention, and infill drilling, in both oil and gas plays.
- Have steered over 50 wells in Texas (Eagleford/Woodbine/Haynesville), Louisiana (Haynesville and Mid Bossier), Mississippi (Tuscaloosa Marine Shale) and rocky mountain exploration wells.
- Contributed to play evaluation through assessment of LWD resistivity suites and their response to oil-filled fracture zones in the Tuscaloosa Marine Shale.  
(September 2011 – September 2012)

### **Operations Geologist, Southwestern Energy Company, Conway, Arkansas**

- Member of a geologic operations team drilling planning and drilling horizontal wells in the Fayetteville Shale. Duties included well planning, real-time well plan adjustment, well site geology, landing and geosteering wells, and data QA/QC.
- Planned (seismic and subsurface mapping), landed and steered over 110 wells with a combined lateral footage of over 550,000 feet in multiple Fayetteville targets.
- Participated in post-drill reviews to analyze drilling, completions, and production results.  
(January 2010-September 2011)

### **Air Rig Supervisor, Southwestern Energy Company, Conway, Arkansas**

- Responsible for supervision of geologic operations consultants working in the Fayetteville shale.
- Coordinated up to four well site consultant geologists on as many as ten drilling rigs, ensuring accurate and optimal geologic total depths, and planning and improving vertical hole geologic operations.  
(March 2010-September 2011)

### **Wireline Logging Coordinator, Southwestern Energy Company, Conway, Arkansas**

- In charge of all operational aspects of wireline logging in the Fayetteville shale.
- Duties include planning logging operations, QA/QC wireline data, evaluate and make recommendations on new tools, and ensure smooth coordination with drilling.  
(March 2010-September 2011)

## EDUCATION

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**Northern Arizona University, Flagstaff, AZ**  
Bachelor of Science, Geology, December 2009

THESIS: Orientation and kinematics of brittle structures in the east Callville Interaction Zone, Lake Mead, Nevada:

- Developed a structural and stratigraphic history of a complex basin in the Central Basin and Range through voluntary senior thesis work on Miocene brittle deformation and syntectonic deposition in Lake Mead area, Nevada.

Advisor: Paul J Umhoefer, PhD.

- Field assistant for Rory San Filippo's master's thesis along the Bitter Spring Valley fault, Lake Mead, Nevada

- Completed courses in field mapping, structural geology, master's level regional tectonics, and advanced field methods

## COMPUTER SKILLS

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Mapping/Well Log Correlation:	Petra and SMT Kingdom Earthpak
Geosteering:	Stoner SES and BHL Boresight
Seismic Interpretation:	SMT Kingdom

## PROFESSIONAL COURSES

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SCA – Well Log Interpretation  
SCA – Seismic Interpretation (2D and 3D)  
AAPG – Geothermal Short Course  
AAPG – Unconventional Log interpretation, Ancient into Modern  
SMT – Kingdom (Earthpak) Training

## HONORS/AWARDS

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Northern Arizona University's Blue and Gold Award for academic excellence in high school.  
Northern Arizona University Dean's list 2006.  
Award of Excellence from the United States Forest Service.  
Nominated for NAU geology department's Senior of the Year (2009).

## PROFESSIONAL MEMBERSHIPS

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American Association of Petroleum Geologists (Active Member)  
Society of Petroleum Engineers

Engineering Testimony—Stephen C. Peters  
Unnamed Field  
Cause No. 535; Docket No. 1309-AW-54  
Spacing Application  
Niobrara Formation

October 28, 2013 Colorado Oil and Gas Conservation Commission Hearing

My name is Stephen C. Peters, and I am currently employed as Manager of Reservoir Engineering for Carrizo Oil & Gas, Inc. (“Carrizo”). I graduated from The University of Texas at Austin in 1974 with a degree in Mathematics. I have over 37 years of experience in drilling and completion, production operations, and reservoir evaluation. A copy of my curriculum vitae is attached to this submittal and marked as Exhibit E-1. I am familiar with the lands that are subject of this matter.

In support of Carrizo’s application today, seven (7) exhibits are submitted. The exhibits are attached to my sworn testimony and form the basis for the above-referenced application (“Application”) for an order approving a drilling unit with the following specifications. The Application requests 15 wellbores per 640 acre unit – maintaining 300’ offsets to the North and West unit boundaries and 600’ offsets to the South and East unit boundaries. For purposes of this analysis, 300’ internal wellbore setbacks are used as a modeling convention. The requested unit is for development of and production from the Niobrara Formation, in the following lands:

Township 9 North, Range 59 West, 6<sup>th</sup> P.M.  
Section 36: All

Weld County, Colorado;

**Exhibit No. E-1** is a copy of my resume/curriculum vitae.

**Exhibit No. E-2** presents anticipated initial formation pressure determined from analysis of a leak-off test performed in Carrizo’s State 36-24-9-61H well. This well is one of two Carrizo wells in which such testing has been performed.

**Exhibit No. E-3** presents anticipated initial formation pressure from the second well in which leak-off testing has been performed, Carrizo’s Bob White 36-44-8-62H.

**Exhibit No. E-4** is a rate-pressure transient analysis (or RTA) which presents historical bottom hole flowing pressures compared to modeled bottom hole flowing pressures in the Carrizo State 36-24-9-61H well. The model incorporates actual rate history and the initial reservoir pressure determined from evaluation of the leak-off test along with the actual completed length of this well and frac half-lengths of 253’.

**Exhibit No. E-5** is a rate-pressure transient analysis which presents historical bottom hole flowing pressures compared to modeled bottom hole flowing pressures in the Carrizo Bob White 36-44-8-62H well. The model incorporates actual rate history and the initial reservoir pressure determined from evaluation of the leak-off test along with the actual completed length of this well and frac half-lengths of 230’.

**Exhibit No. E-6** presents specific calculations for two example wells with reservoir properties equal to those observed in Carrizo’s State 36-24-9-61H and Carrizo’s Bob White 36-44-8-62H but with lateral lengths, frac half-lengths and drainage widths adjusted to accommodate the proposed spacing dimensions. The anticipated EUR for each of these two example wells was determined by RTA modeling and forecasting. The same effective permeability which resulted from matching the rate-pressure histories of the two wells (referenced in Exhibits E-4 and E-5) were used in modeling the example wells and the number of frac stages were adjusted to accommodate the revised lateral lengths.

**Exhibit E-7** presents results of economic analyses of the two example wells.

**Findings from engineering analyses of information presented in the attached exhibits are summarized below:**

- Carrizo’s State 36-24-9-61H well appears to have been completed in a reservoir with initial pressure of 2912 psia and average effective (stimulated) permeability of 1.20 micro-darcies. The completed lateral length of this wellbore is 3245’ incorporating 11 frac stages with apparent half-lengths of 253’. A well with a completed lateral length of 4380’ incorporating 17 fracs with 150’ half-lengths placed in a similar reservoir and limited to 300’ internal spacing should exhibit an Estimated Ultimate Recovery (EUR) of 120.4 thousand oilfield barrels of oil (MBO) plus associated gas and processed natural gas liquids (NGL’s). Economics for such a well are sound.
- Carrizo’s Bob White 36-44-8-62H well appears to have been completed in a reservoir with initial pressure of 3259 psia and average effective permeability of 0.65 micro-darcies. The completed lateral length of this wellbore is 3484’ incorporating 14 frac stages with apparent half-lengths of 230’. A well with a completed lateral length of 4380’ incorporating 17 fracs with 150’ half-lengths placed in a similar reservoir and limited to 300’ internal spacing should exhibit an Estimated Ultimate Recovery (EUR) of 83.6 thousand oilfield barrels of oil (MBO) plus associated gas and processed natural gas liquids (NGL’s). Economics for such a well are sound.



STEPHEN C. PETERS  
Carrizo Oil & Gas, Inc.  
500 Dallas Street, Suite 2300, Houston, TX 77002  
(713) 328-1000

EXHIBIT E-1 (CURRICULUM VITAE)

1996-Present: Manager of Reservoir Engineering  
Carrizo Oil & Gas, Inc.

- Reservoir engineer for Gulf Coast, East Texas, Rocky Mountains and Eastern US areas - Carrizo Oil & Gas, Inc.
- Work with third party engineering firms in formulation of SEC year-end reports and periodic updates as needed.
  - Organize and maintain reserve portfolios in ARIES database. Perform volumetric and material balance calculations (with dynamic modeling) as back-up for reserve assignments.
  - Evaluate (for participation elections) majority of proposed work on outside operated properties.
  - Work closely with CFO and Bankers in generating loan basis for Senior Debt.
  - Work closely with Operations Department in evaluating candidates for stimulation, compression, acceleration and/or plugging.
  - Work closely with Exploration and Operations Departments in evaluating drilling prospects and acquisitions.

1995-1996: Senior Petroleum Engineer  
Pennzoil, Offshore Division, Houston, Texas

Headed Asset Team charged with expediting development projects for offshore properties located in the western Gulf of Mexico.

1992-1994: Senior Petroleum Engineer  
Pennzoil, South Texas Division, Houston, Texas

Served as chief engineer for 6 company operated oil and gas fields located in Aransas, Refugio and Victoria Counties, Texas. Directly involved with production and development operations.

1990-1991: Senior Petroleum Engineer  
Pennzoil, Western Division, Houston, Texas

Served as Joint Interest Coordinator for Western Division. Expedited approvals for expenditure (AFE's), reviewed joint venture invoices and approved for payment, interpreted gas balancing agreements and gas processing agreements, administered Joint Operating Agreements, and represented company in communications with joint interest owners.

1985-1989: Senior Petroleum Engineer  
Proven Properties Inc., Houston, Texas (Acquisitions Company Partially Owned by Pennzoil)

Evaluated reserves, prepared estimates of future cash flows and assigned bid values to producing oil and gas properties designated as purchase candidates.

1979-1984: Supervisory Petroleum Engineer  
Pennzoil, Offshore Division, Houston, Texas

Served as field engineer for 5 company operated and 4 non-operated offshore fields in western Gulf of Mexico. Earned promotion to Supervisory Engineer and exercised staff authority over 5 field engineers in Pennzoil's Houston Marine District.

1976-1978: Drilling Engineer  
Pennzoil, Offshore Division, Houston, Texas

Served as on-site supervisor for drilling, completion and workover operations on offshore wells, western Gulf of Mexico.

1975: Mud Engineer/Mud Logger  
DMCO Services, Houston, Texas

Served as on-site drilling fluids specialist on wells in Gulf of Mexico, Abu Dhabi and North Slope Alaska.

EDUCATION and MEMBERSHIPS

B.A. Mathematics (High Honors)-The University of Texas at Austin-January 1975

26 Year Member - Society of Petroleum Engineers

Exhibit E-2

**Carrizo State 36-24-9-61 H**  
**P\* from Fall-Off**

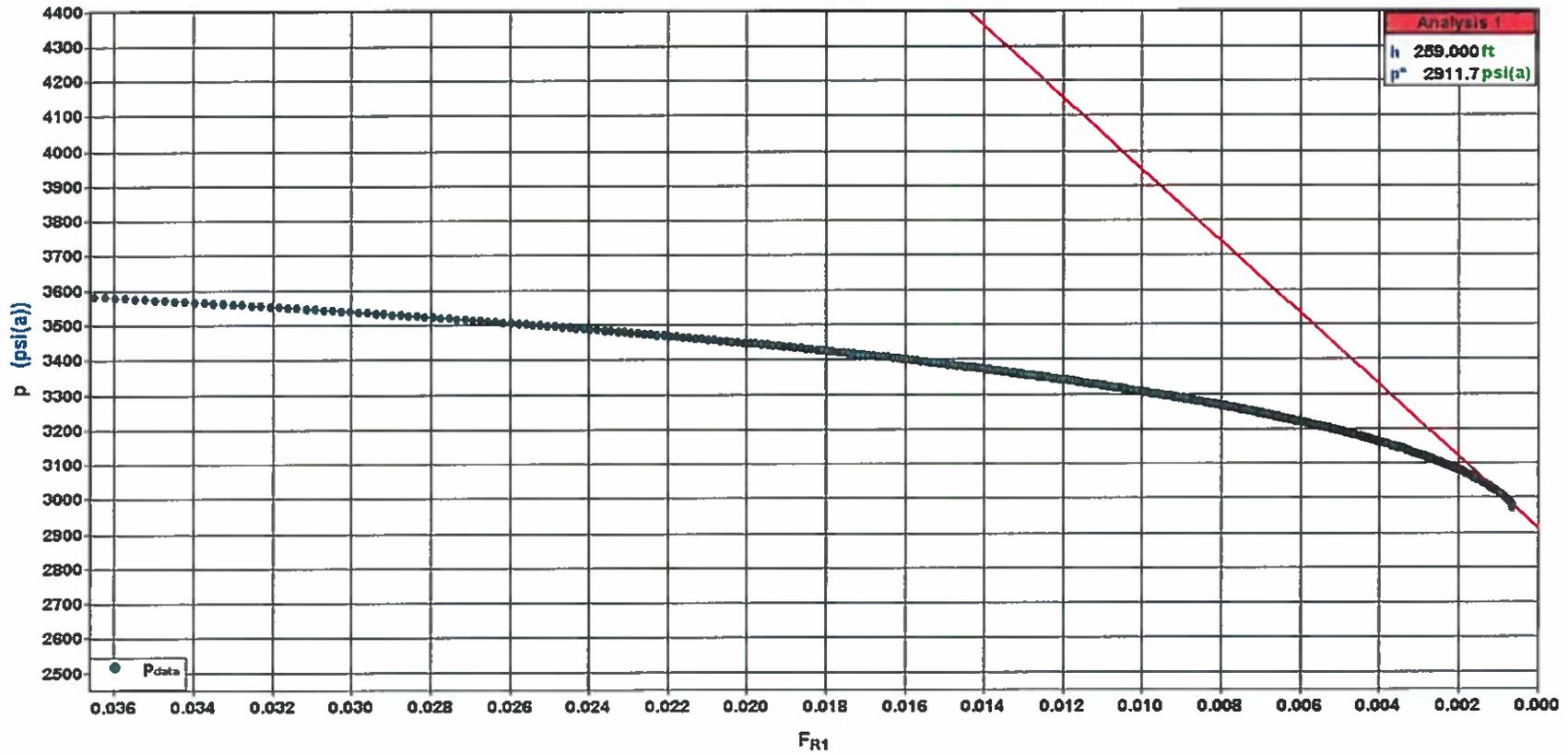


Exhibit E-3

**Carrizo Bob White 36-44-8-62 H**  
**P\* from Fall-Off**

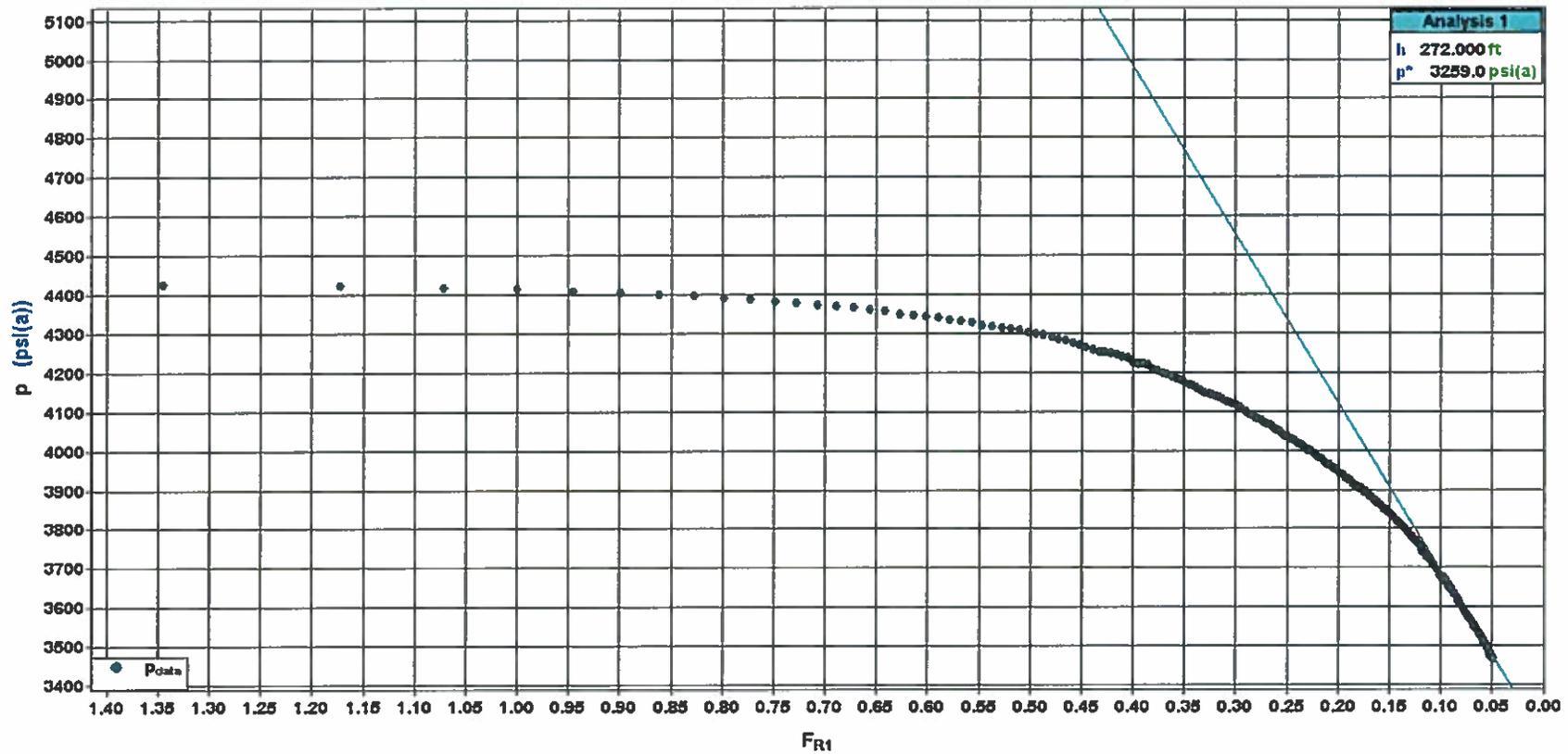


Exhibit E-4

State 36-24-9-61 H Enhanced Frac Model  
3245' Lateral, Xf = 253' w/ 1.2 micro-darcies Perm

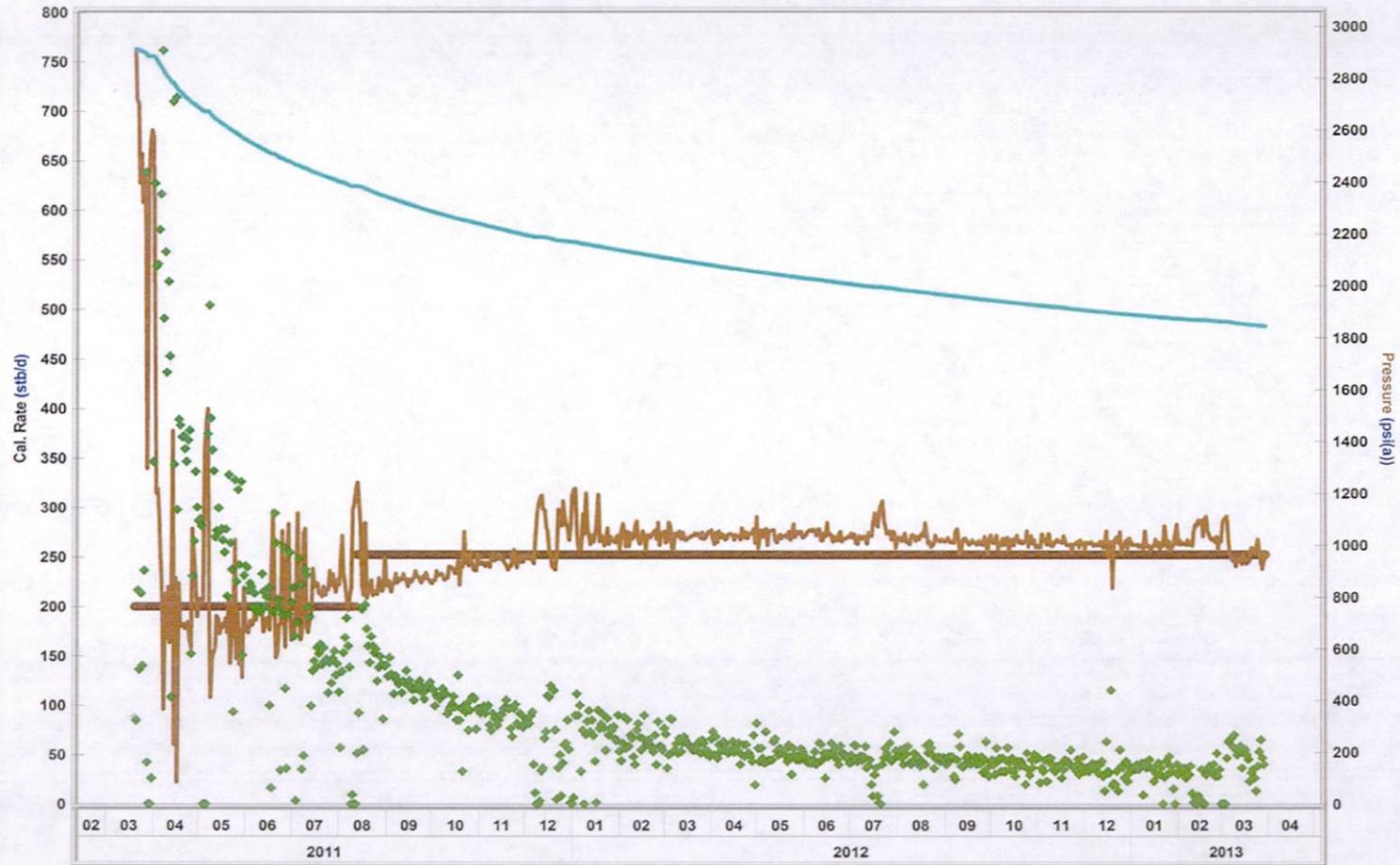
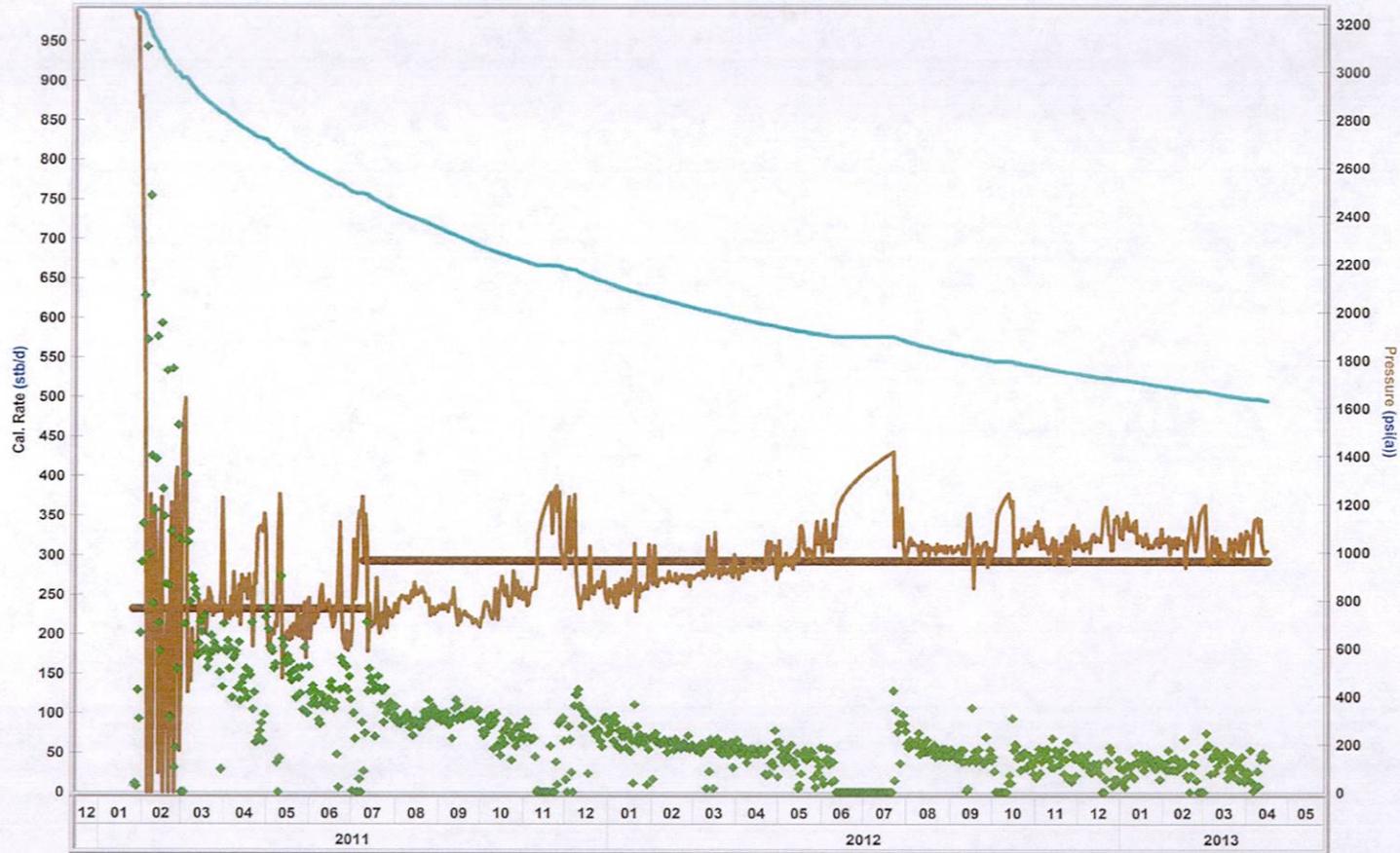


Exhibit E-5

Bob White 36-44-8-62 H Enhanced Frac Model  
3415' Lateral Xf = 230' w/ 0.65 micro-darcies Perm



**Exhibit E-6**

**Carrizo Oil & Gas, Inc. - Volumetric Oil Reserve Worksheet  
Niobrara "B" and "C" Lobes — ("A" Lobe is Excluded)**

**Example Well Based on Properties Identified in Carrizo State 36-24-9-61H**

Description of Parameter	Value of Parameter
Depth (TVD below Ground Level)	6,350
Porosity	9.40%
Sw (Water Saturation-Percent of Pore Space)	35.00%
Height (Thickness) of Formation	185
Initial Reservoir Pressure (PSIA)	2,912
Initial Reservoir Temperature (degF)	217
Initial Gas-Oil Ratio (CuFt/Stock Tank Bbl)	650
Oil Gravity (deg API)	38.0
Sep Gas Gravity (air = 1.0)	0.88
Formation Volume Factor (Reservoir Bbls/Stock Tank Bbl)	1.374
Lateral Section Drained (Ft) = Length of Completed Horizontal Wellbore	4,380
Width of Drainage (Ft) = Spacing Distance Between Wellbores	300
Acres in Drained Area	30.2
Original Stock Tank Oil in Place (Mbbbl) per Spacing Unit assuming uniform Height	1,625.2
Modeled EUR to Economic Operating Limit (MBbls)	120.4
Anticipated Recovery Efficiency at Stipulated Spacing	6.3%

**Example Well Based on Properties Identified in Carrizo Bob White 36-44-8-62H**

Description of Parameter	Value of Parameter
Depth (TVD below Ground Level)	6,600
Porosity	6.56%
Sw (Water Saturation-Percent of Pore Space)	35.00%
Height (Thickness) of Formation	164
Initial Reservoir Pressure (PSIA)	3,259
Initial Reservoir Temperature (degF)	218
Initial Gas-Oil Ratio (CuFt/Stock Tank Bbl)	900
Oil Gravity (deg API)	38.0
Sep Gas Gravity (air = 1.0)	0.88
Formation Volume Factor (Reservoir Bbls/Stock Tank Bbl)	1.497
Lateral Section Drained (Ft) = Length of Completed Horizontal Wellbore	4,380
Width of Drainage (Ft) = Spacing Distance Between Wellbores	300
Acres in Drained Area	30.2
Original Stock Tank Oil in Place (Mbbbl) per Spacing Unit assuming uniform Height	1,093.2
Modeled EUR to Economic Operating Limit (MBbls)	83.6
Anticipated Recovery Efficiency at Stipulated Spacing	7.7%

Exhibit E-7

Niobrara Formation Drilling & Spacing Unit Application

Economic Calculations-Example Wells With 300' Internal Offsets

	CAPEX \$/M	Oil Price \$/Bbl (NYMEX)	Gas Price \$/MCF (NYMEX)	Oil EUR MBbl	Gas EUR MMCF	NPV <sub>10</sub> B/FIT \$M	DCFROR %	Disc ROI	Discounted Payout (Yrs)
<b>Well Based on State 36-24-6-61H Properties</b>									
Unrisked:	\$4,050.0	\$100.00	\$4.00	120.4	155.6	\$2,295.1	52.1%	1.57	1.94
<b>Well Based on Bob White 36-44-8-62H Properties</b>									
Unrisked:	\$4,050.0	\$100.00	\$4.00	83.6	237.3	\$704.8	21.3%	1.18	4.02

Key Assumptions

Operating Expenses \$5,600/Month plus \$1.98/Bbl  
WI = 100.000%, Royalty = 18.000%, NRI = 82.000%

The economics for these projects are sound.