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# EXHIBIT(s) FOR ORDER NO(s).

421 - 1

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**DOCKET # 1002-SP-06 Cause 421**

**GEOLOGY TESTIMONY**

**PROPOSED 640 ACRE DRILLING AND SPACING UNIT**

**NIOBRARA FORMATION**

**PARTS OF T11&12N-R62-63W, 6<sup>th</sup> PM**

**WELD COUNTY, COLORADO - FEB. 22, 2010**

***Prepared and Submitted by John H. Melby, Petroleum Geologist – EOG Resources***

The Niobrara Formation is sequence of Chalks, Marls and Limestones that were deposited in the Western Interior Seaway during Cretaceous time. This seaway was vast in extent and covered much of North America from the Gulf of Mexico to the Arctic. These rocks were deposited as deep water sediments and underlie most of the DJ Basin in parts of northeastern Colorado, southeastern Wyoming and southwestern Nebraska.

Four geology exhibits were prepared and presented as follows:

**I. Exhibit G-1 – (Structure Map-C.I.=50')**

Exhibit G-1 is a subsea structure map constructed on the top of the Niobrara Formation. In the application area, the regional dip is approximately 40-50'/mile (.5 degree) to the west.

**II. Exhibit G-2 – (Isopach Map-C.I.=10')**

Exhibit G-2 is an isopach map of the total Niobrara Formation. Total thickness ranges from approximately 250' to 290' under the proposed spaced area with the thickest area in the southern portion of the proposed spaced area.

**III. Exhibit G-3 – (Niobrara-Type Log)**

Exhibit G-3 is an AIT type log for the Niobrara Formation. The Niobrara consists of two members, the Smoky Hill Chalk and the Ft. Hayes Limestone.

**IV. Exhibit G-4 (Cross Section A-A')**

Exhibit G-4 is a stratigraphic cross section constructed through nearby wells showing the mapped interval of the Niobrara Formation. This exhibit shows that the Niobrara Formation exists under the proposed spacing area. The location of cross section A-A' is shown on Exhibit G-1 & G-2.

**Conclusion,** the Niobrara Formation exists under all lands in the spacing application area.



**WY**  
**CO**

TYPE LOG

12N 63W

12N 62W

A

11N 63W

11N 62W



DOCKET # 1002-SP-06  
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EXHIBIT G -2



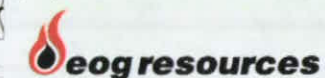
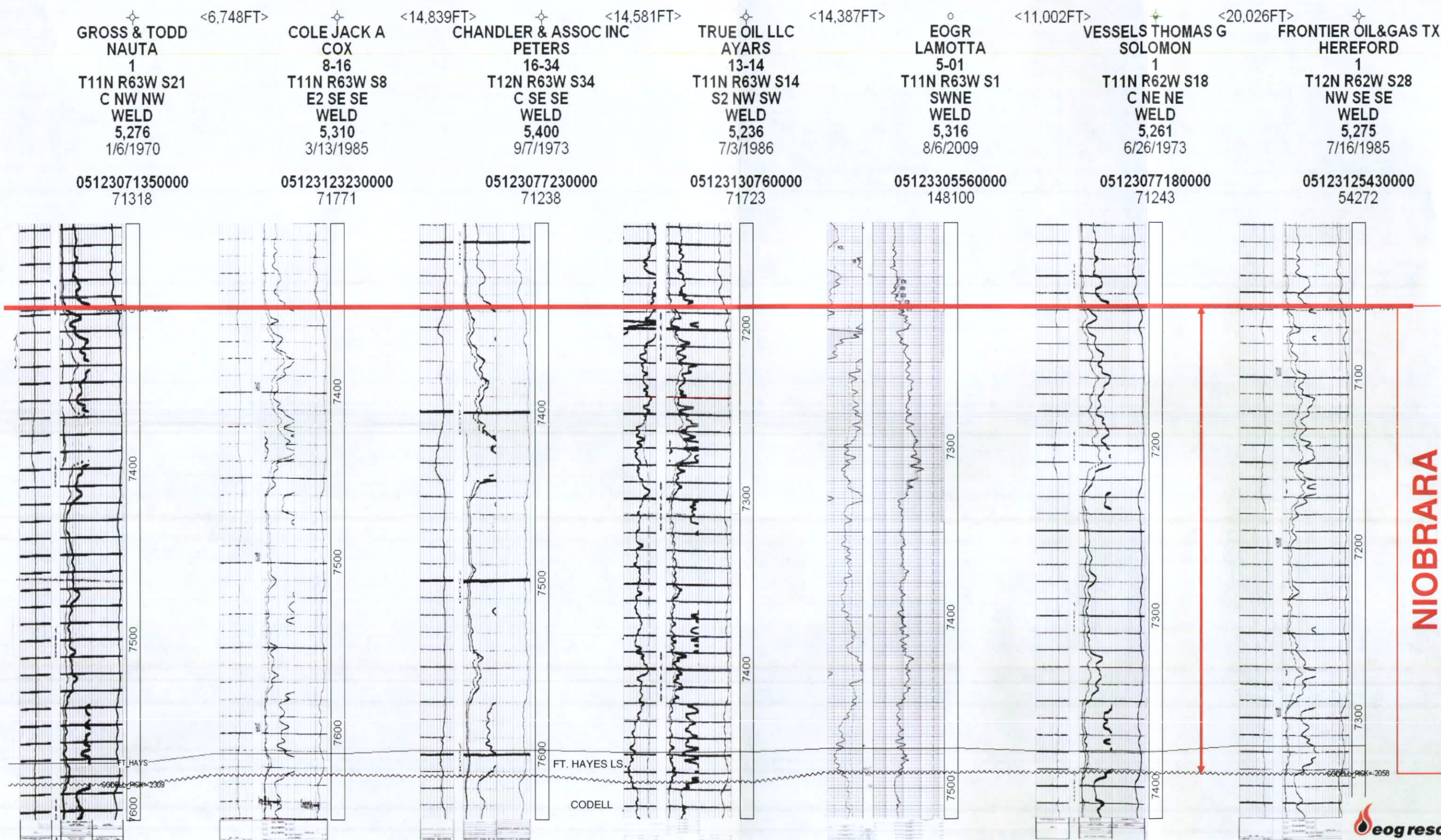




A

## NIOBRARA CROSS SECTION

A'





EOGR  
LAMOTTA 5-01M  
T11N-R63W-1  
Weid Co., Colo.

Pierre Sh.

NIOBRARA

SMOKY HILL CHALK

UPPER CRETACEOUS

Ft. Hayes  
L.S.

Codell

Carlisle Sh.



NIOBRARA  
TYPE LOG



DOCKET # 1002-SP-  
06 Cause 421  
EXHIBIT G-3

**Engineering Testimony  
Weld County, Colorado  
Cause No. 421, Docket No. 1002-SP-06  
EOG Resources, Inc.  
Spacing Application  
Niobrara Formation**

My name is Osman Apaydin. I am a reservoir engineer with EOG Resources, Inc. I have over 10 years experience in reservoir engineering, production operations, facility engineering and related matters and am familiar with the engineering conditions with respect the Application Lands. A copy of my curriculum vitae is included in the exhibit booklet submitted by EOG.

**Drainage and Economic Calculations**

Exhibit E-1 reflects the original oil in place, estimated ultimate recovery, porosity and calculated drainage area for a number of wells within the Application Lands. Vertical well oil production performance is highly variable out of Niobrara Formation. Besides much poorer wells, the only vertical well that has significant production in the area is Kern 43-33 well. Our studies reflect that the EUR is approximately 38,450 BBL for this well and the original oil in place is 769,293 BBL. The corresponding drainage area for the vertical well is 23 acres. EUR estimate for the first exploratory horizontal well Jake 2-01H, with limited production history, is around 250,000 BBL and the original oil in place is 5,000,000 BBL. Estimated drainage area is 152 acres. The second exploratory well, Elmer 8-31H is at its completion stage.

Exhibit E-2 reflects the original oil in place, estimated ultimate recovery, porosity and calculated drainage area for a number of wells from an analog field named Silo. This is a major field producing from Niobrara Formation (25 Miles North) and produced around 10,000,000 BBL since early 1980's though vertical and horizontal wells. EUR and drainage area estimates for some of the high and low productive wells are also included in the analysis. Drainage area varies between 35 to 492 Acres.

Exhibit E-3 shows that the economics of this project are sound.

Based upon my engineering analysis, the current drilling and spacing units will promote efficient drainage, protect correlative rights and avoid waste. We do not believe that granting this Application will adversely affect correlative rights.

Engineering Exhibits E-1 through E-3 were prepared under my direction and control.

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EOG Resources, Inc.  
Reservoir Engineer



# Niobrara Formation Drilling & Spacing Unit Application

## Hereford Field

### Drainage Calculations

WELL NAME	API NO	Well Orientation	FIELD	SEC.	TSHP.	RGE.	EUR OIL (BBL)	OOIP(BBL)	h(ft)	Porosity	Calculated Drainage Area (Acres)
KERN 43-33	5123102680002	Vertical	HEREFORD	33.0	12N	62W	38,450	769,000	80	0.10	23
JAKE 2-01H	5123305740000	Horizontal	HEREFORD	1.0	11N	63W	250,000	5,000,000	80	0.10	152

$B_o =$	1.2	rb/STB (from Observed API Gravity and GOR data)
$S_w =$	0.35	fraction (calculated from Archie $S_w$ calculation)
$RF =$	0.05	fraction (assumed)

Equations used:

$$OOIP = EUR / RF$$

$$Area = OOIP * B_o / 7758 / h / por / (1 - S_w)$$

where:

OOIP = original oil in place (BBL)  
 EUR = estimated ultimate recovery (BBL)  
 RF = recovery factor (fraction)  
 Area = drainage area (acres)  
 $B_o$  = formation volume factor (rb/STB)  
 h = thickness, (ft)  
 por = porosity (fraction)  
 $S_w$  = water saturation (fraction)

Exhibit E-1  
 Docket No 1002-SP-06  
 Cause No 421



Niobrara Formation Drilling & Spacing Unit Application  
Silo Field  
Drainage Calculations

WELLNAME	API NO	Well Orientation	FIELD	SEC.	TSHP.	RGE.	EUR OIL (BBL)	OOIP(BBL)	h(ft)	Porosity	Calculated Drainage Area (Acres)	Section Drainage Area Total (Acres)
EPLER S E	49021203540000	Vertical	SILO	31.0	16N	64W	92,122	1,842,449	80	0.10	56	
LEROY GOERTZ C 2	49021203620000	Vertical	SILO	31.0	16N	64W	407,026	8,140,512	80	0.10	247	
GOERTZ LEROY B 1	49021202600001	Vertical	SILO	31.0	16N	64W	304,270	6,085,400	80	0.10	185	
LEROY GOERTZ D 1	49021203780000	Vertical	SILO	31.0	16N	64W	5,543	110,860	80	0.10	3	
LEROY GOERTZ E-1	49021203770000	Vertical	SILO	31.0	16N	64W	1,904	38,080	80	0.10	1	492
LEMASTER STATE 12 32 1 H	49021204510000	Horizontal	SILO	32.0	16N	64W	625,739	12,514,771	80	0.10	380	
STATE OF WYOMING Y 1	49021203000000	Vertical	SILO	32.0	16N	64W	2,914	58,280	80	0.10	2	
STATE OF WYOMING Y 2	49021203120000	Vertical	SILO	32.0	16N	64W	163	3,260	80	0.10	0	382
LEROY 41-33 1-H	49021204630000	Horizontal	SILO	33.0	16N	64W	481,703	9,634,051	80	0.10	287	
SO PRINCE 2	49021203260000	Vertical	SILO	33.0	16N	64W	48,145	962,900	80	0.10	29	
SOUTH PRINCE 1	49021202940000	Vertical	SILO	33.0	16N	64W	36,967	739,340	80	0.10	22	337
BIGHORN STATE 41-34 1H	49021204990000	Horizontal	SILO	34.0	16N	64W	49,268	985,360	80	0.10	29	
STATE 1-34	49021203460000	Vertical	SILO	34.0	16N	64W	8,934	178,680	80	0.10	5	35
STATE 4-9H	49021204280000	Horizontal	SILO	4.0	15N	64W	232,425	4,648,492	80	0.10	138	138
MCGAHAN 21-5 1H	49021204180200	Horizontal	SILO	5.0	15N	64W	63,346	1,266,918	80	0.10	38	
MCGAHAN 21-5 1H	49021204180000	Horizontal	SILO	5.0	15N	64W	59,245	1,184,900	80	0.10	35	
MCGAHAN 21-5 1H	49021204180100	Horizontal	SILO	5.0	15N	64W	112,616	2,252,320	80	0.10	67	
CHAMPLIN 300 AMOCO B 1	49021202280000	Vertical	SILO	5.0	15N	64W	24,644	492,880	80	0.10	15	
LEE 32-5 2	49021203590000	Vertical	SILO	5.0	15N	64W	2,554	51,080	80	0.10	2	
LEE 41-5 1	49021203490000	Vertical	SILO	5.0	15N	64W	20,344	406,880	80	0.10	12	168
BLEVINS OIL UNIT 1H	49021204320000	Horizontal	SILO	6.0	15N	64W	204,126	4,082,520	80	0.10	121	121
PACE OIL UNIT 1 H	49021204600000	Horizontal	SILO	7.0	15N	64W	113,846	2,276,926	80	0.10	68	
WARREN 1	49021203560000	Vertical	SILO	7.0	15N	64W	27,607	552,140	80	0.10	16	84
OWEN 1H 14-9	49021204620100	Horizontal	SILO	9.0	15N	64W	40,233	804,659	80	0.10	24	
OWEN 14-9 1-11	49021204620000	Horizontal	SILO	9.0	15N	64W	116,140	2,322,800	80	0.10	69	93

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 $RF = 0.05$  fraction (assumed)

Equations used:

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 Area = drainage area (acres)  
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 h = thickness, (ft)  
 por = porosity (fraction)  
 $S_w$  = water saturation (fraction)

Exhibit E-2  
 Docket No 1002-SP-06  
 Cause No 421



# Niobrara Formation Drilling & Spacing Unit Application

## Hereford Field

### Economic Calculations

CAPEX, \$M	Oil Price, \$/BBL	Gas Price, \$/MCF	NPV <sub>10</sub> , \$M	ROR, %	EUR, Oil, MBO	EUR, Gas, MMCF
4500.0	70.0	5.5	3270.0	92.0	250.0	161.0
<b>Production @ 60%</b>			18.8	10.3	150.0	79.0

#### Key Assumptions

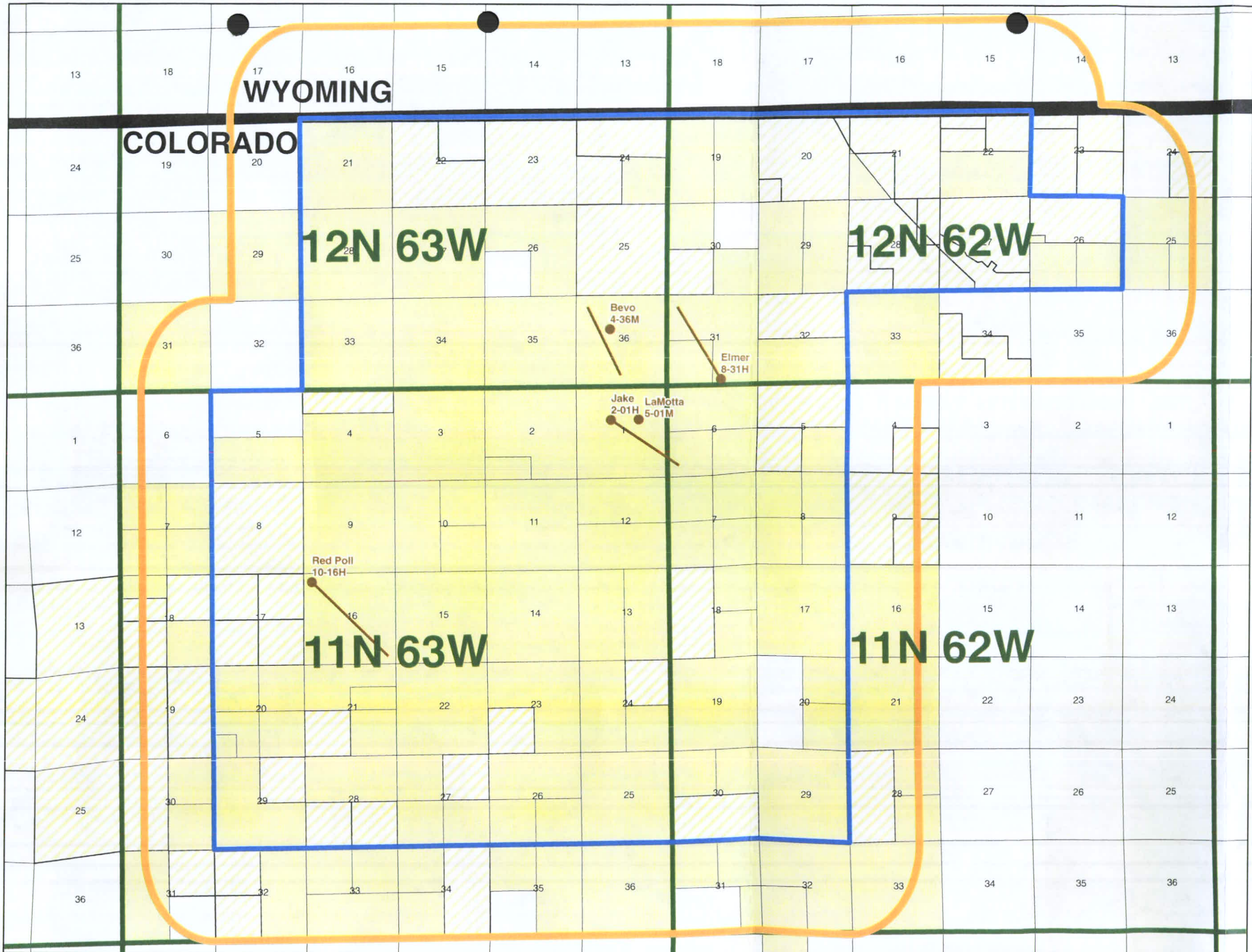
OPEX \$3500/Month

WI 100%, Royalty 20%, NRI 80%

The economics for this project are sound.

Exhibit E-3  
Docket No 1002-SP-06  
Cause No 421





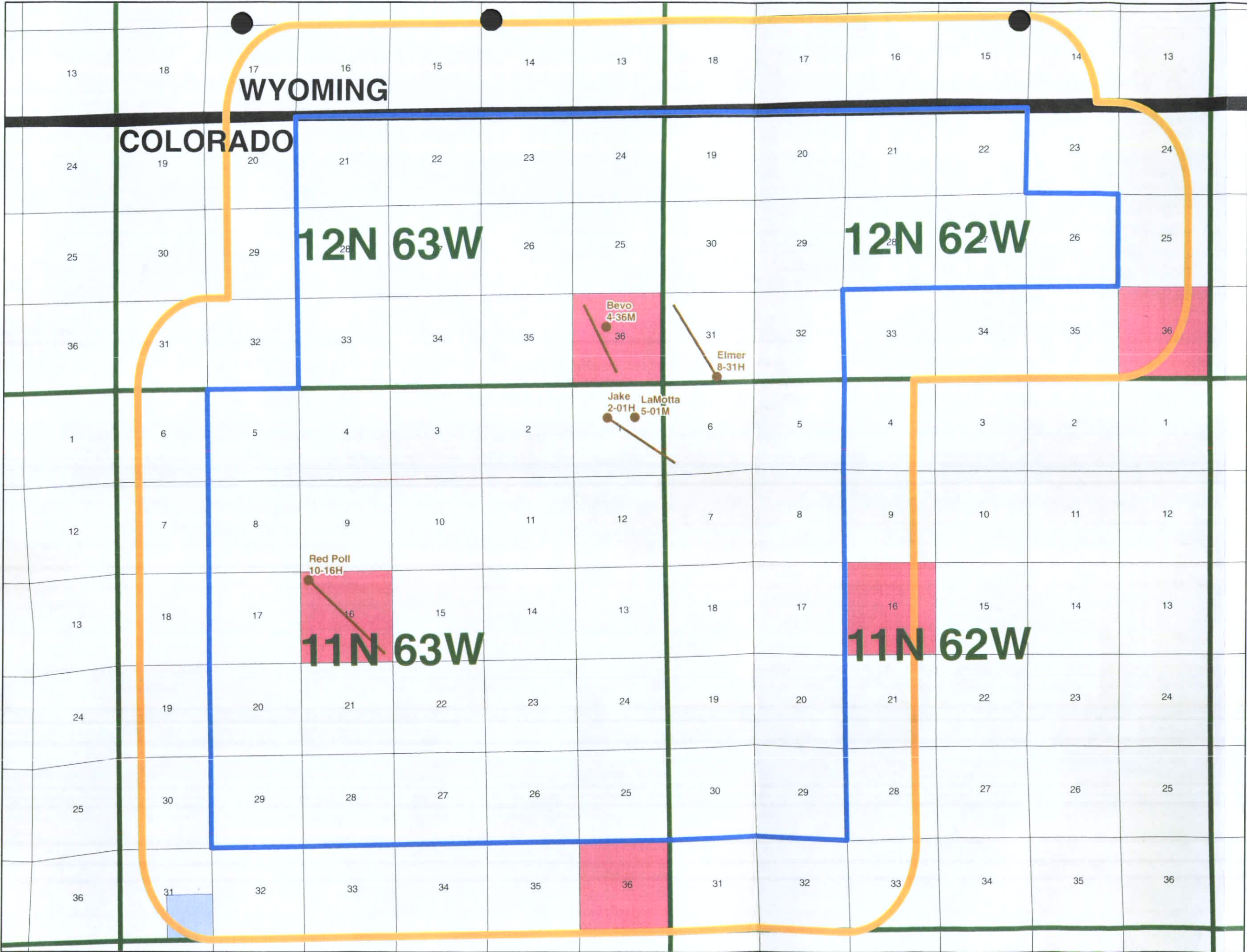
**Legend**

- Wells
- Well Line
- EOG Full Interest
- EOG Partial Interest
- Pooling Application Area
- Pooling Application Area 1 Mile Buffer





- Legend**
- Wells
  - Well Line
  - Active State Minerals
  - Inactive State Minerals
  - Pooling Application Area
  - Pooling Application Area 1 Mile Buffer





Docket #1002-SP-06  
Cause 421  
Exhibit L-3



### Legend

- Wells
- Well Line
- Pooling Application Area
- Pooling Application Area 1 Mile Buffer