

# Cement Ticket

API Well Number:

**34-099-2-3157-00-00**

## Record of Casing, Cementing and Mudding

Well Owner: NORTHSTAR #3 LLC Permit Issued: \_\_\_\_\_  
Lease Name: \_\_\_\_\_ Well No. \_\_\_\_\_ Date Commenced: 08/18/2011  
County: MAHONING Township: COITSVILLE Date Completed: \_\_\_\_\_  
Driller: UNION DRLG Tool RTAF LTD 0 DTD \_\_\_\_\_  
TD Formation MAHONING Class \_\_\_\_\_

Comments: HL #2 13.5 inch TD at 1025' Surface casing was R-3 40.5 lb J55 New 10.75 inch pipe, set with guide shoe, float collar and 15 centralizers. Centralizers set every other joint. Operator ran 26 joints of 10.75 inch pipe, pipe set at 1019' KB actual pipe in hole 1003'. Operator Broke circulation, ran 1000 gallons of Sweep, 1000lb of gel and two 50lb bags of unicele. Operator then mixed cement ran 449 sacks of class A 3% CaCl.2% foam Chch and 1/4 sack of unicele. Operator cement to 940'= 92.2 Bbl of fresh water. During displacement 30Bbl return of good cement to surface. 1019' X

### Strings

FLD  \*Hole 2 Field Entry Bot  1025 Diam  13.5 Top  0 LENGTH

Set Dt  SHOT/RIP:  CSG\_REC'D:

CMMT Casing Condition,  
Weight and Cement Basket

### Cement

CONDITION  WEIGHT

BOC  0 TOC  0 DT\_CM  Duration   WITNESSED

CMT\_CON  INSPECTOR HILL TOM

CLASS\_CMT:  SACKS  YIELD

CLASS\_CMT2:  SACKS2  GEL\_VISC

Cement Comments

Centralizer Wiper Plug  
Shoe Collar Other

# Strings

FLD  Packer  Bot  7986 Diam  Top  0 LENGTH

Set Dt  2/17/2011 SHOT/RIP:  CSG\_REC'D:

CMMT Casing Condition, Weight and Cement Basket  BAKER LOK-SET T-440

# Cement

CONDITION  New WEIGHT

BOC  0 TOC  0 DT\_CM  Duration   WITNESSED

CMT\_CON  INSPECTOR

CLASS\_CMT:  SACKS  YIELD

CLASS\_CMT2:  SACKS2  GEL\_VISC  0

Cement Comments   
Centralizer Wiper Plug  
Shoe Collar Other

# Strings

FLD  Production Casing Bot  8098 Diam  7.625 Top  0 LENGTH

Set Dt  10/3/2011 SHOT/RIP:  CSG\_REC'D:

CMMT Casing Condition, Weight and Cement Basket  CEMENTED WITH 221 SACKS

# Cement

CONDITION  New WEIGHT

BOC  0 TOC  0 DT\_CM  Duration   WITNESSED

CMT\_CON  UNIVERSAL WELL SERVICES INSPECTOR  ROBERTS CARL

CLASS\_CMT:  Unitropic SACKS  221 YIELD

CLASS\_CMT2:  SACKS2  GEL\_VISC  0

Cement Comments   
Centralizer Wiper Plug  
Shoe Collar Other

# Strings

FLD  \*Surface Casing Fiel Bot  1019 Diam  10.75 Top  0 LENGTH

Set Dt  9/2/2011 SHOT/RIP:  CSG\_REC'D:

CMMT Casing Condition,  
Weight and Cement Basket

R-3 New 40.5lb pipe, guide shoe, float collar and 15 centralizers

# Cement

CONDITION  New WEIGHT  15.6

BOC  0 TOC  0 DT\_CM  Duration   WITNESSED

CMT\_CON  UNIVERSAL WELL SERVICES INSPECTOR  HILL TOM

CLASS\_CMT:  Class A Cement SACKS  449 YIELD  1.18

CLASS\_CMT2:  SACKS2  GEL\_VISC

Cement Comments  
Centralizer Wiper Plug  
Shoe Collar Other

1/4 sack of unicele, 3% CaCl, .2% foam chch

# Strings

FLD  Tubing 1 Bot  7986 Diam  4.5 Top  0 LENGTH

Set Dt  2/17/2011 SHOT/RIP:  CSG\_REC'D:

CMMT Casing Condition,  
Weight and Cement Basket

# Cement

CONDITION  New WEIGHT

BOC  0 TOC  0 DT\_CM  Duration   WITNESSED

CMT\_CON  INSPECTOR

CLASS\_CMT:  SACKS  YIELD

CLASS\_CMT2:  SACKS2  GEL\_VISC  0

Cement Comments  
Centralizer Wiper Plug  
Shoe Collar Other

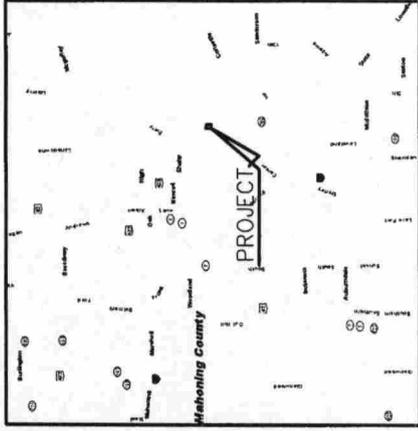
# NORTH STAR NO.3

## SALTWATER INJECTION WELL FACILITY PLANS

43-A MCCARTNEY ROAD, CAMPBELL, OH 44405

INDEX OF SHEETS:

DIMENSIONAL LAYOUT.....	1
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STORAGE TANK PLANS.....	5
OIL/WATER SEPARATOR PLANS.....	6
SETTLING TANK PLANS.....	7
HYDRAULIC SCHEMATIC PLANS.....	8



VICINITY MAP

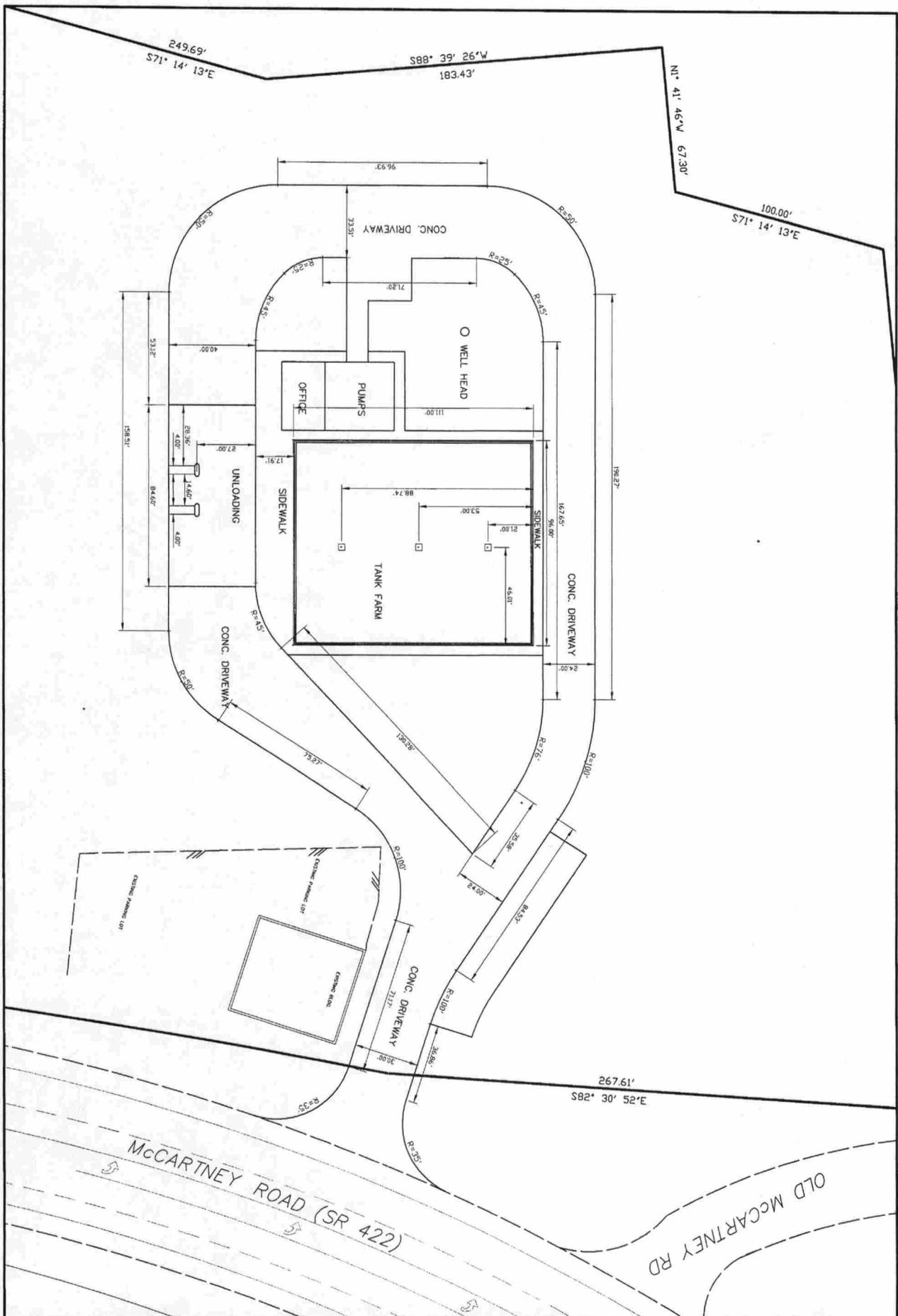
PREPARED FOR:  
**NORTHSTAR #3, LLC**  
 c/o Rex Energy  
 476 Rolling Ridge Drive, Suite 300  
 State College, PA 16801  
 814-278-7267

PREPARED BY:  
**TOTAL DESIGN ENGINEERING, LLC**  
 Civil Engineering & Surveying  
 2761 Salt Springs Road  
 Youngstown, Ohio 44509  
 330-207-5502  
 Gary Tarteri, PE  
 P.E.



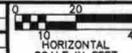
DATE  
 1/4/12

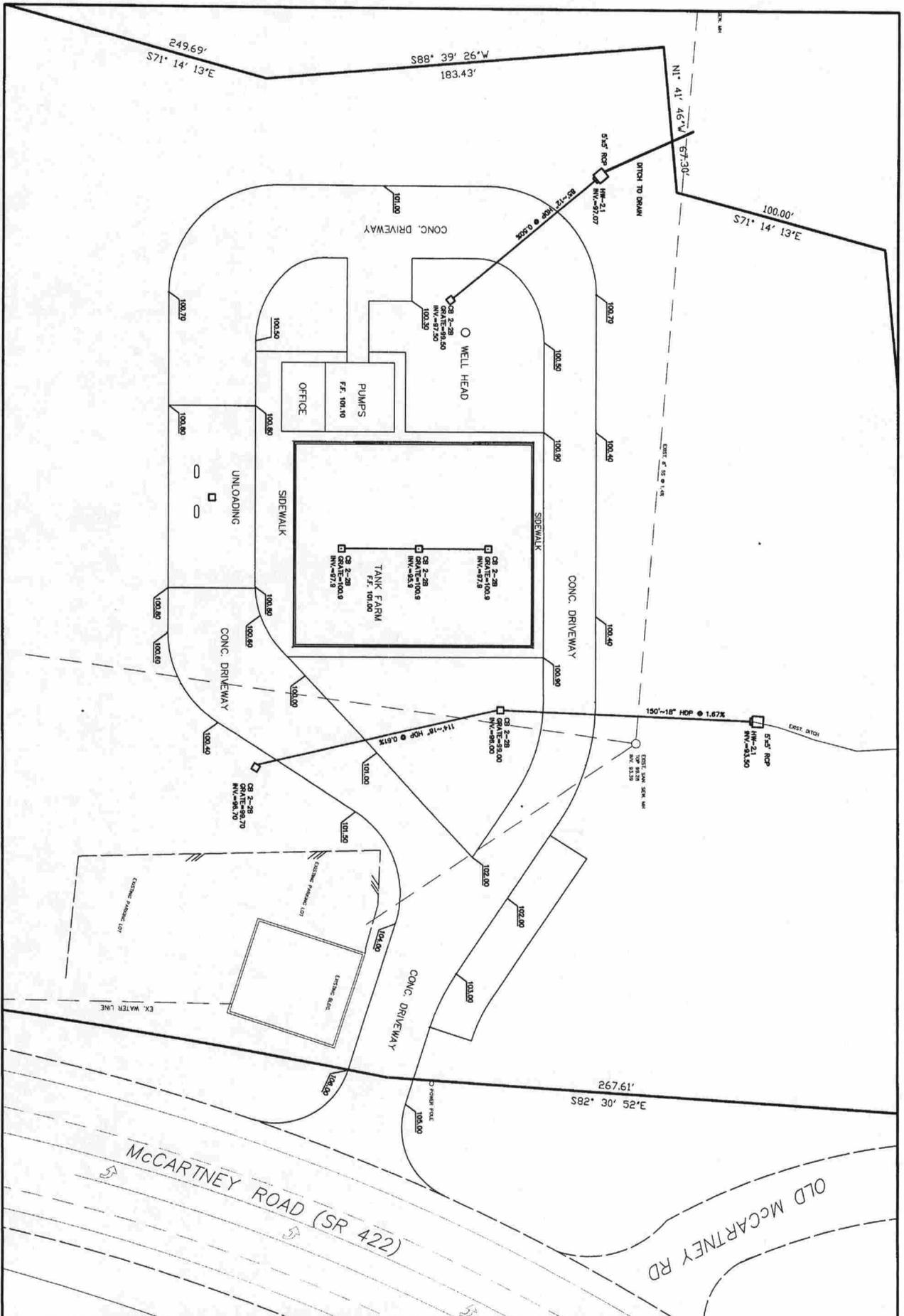
GARY R. TARTERI, P.E.  
 DATE




**TOTAL DESIGN ENGINEERING, LLC**  
 2781 Salt Springs Road  
 Youngstown, OH 44309  
 330-207-5502

**NORTHSTAR #3 LLC DISPOSAL WELL PROJECT**  
**DIMENSIONAL LAYOUT**

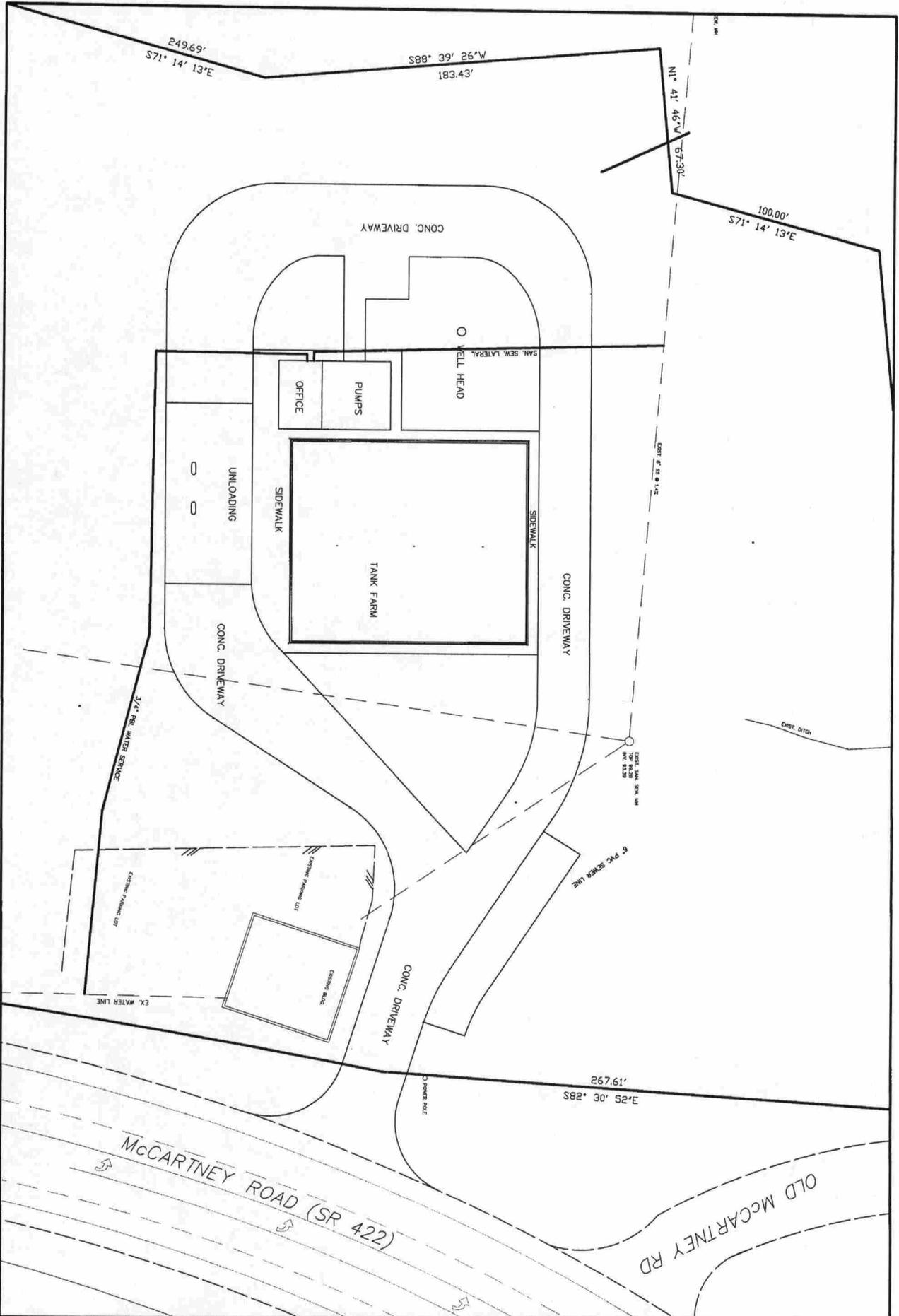
DATE:	0	 HORIZONTAL SCALE IN FEET	
BY:	0		
DATE:	0		
DATE:	0		




**TOTAL DESIGN ENGINEERING, LLC**  
 2761 Salt Springs Road  
 Youngstown, OH 44509  
 330-207-3502

**NORTHSTAR #3 LLC DISPOSAL WELL PROJECT**  
**PAVING, GRADING AND DRAINAGE PLAN**

CALC. BY: _____ DATE: _____ DESIGNED BY: _____ DATE: _____	 HORIZONTAL SCALE IN FEET	
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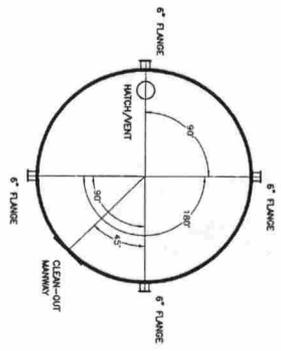



**TOTAL DESIGN ENGINEERING, LLC**  
 2761 Salt Springs Road  
 Youngstown, OH 44509  
 330-207-5502

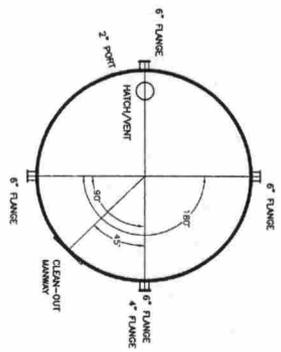
**NORTHSTAR #3 LLC DISPOSAL WELL PROJECT**  
**UTILITY PLAN**

DATE:	0	20	40	
SCALE:	10	20	40	
HORIZONTAL	SCALE IN FEET			
DATE:				

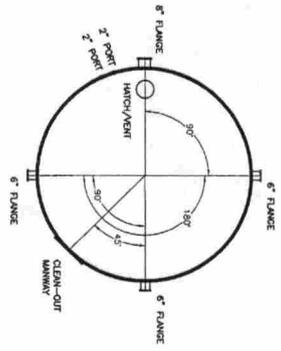




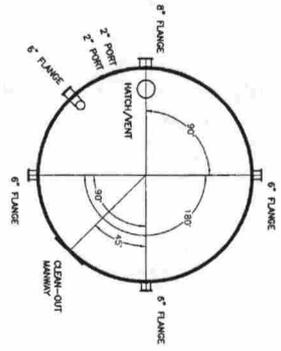
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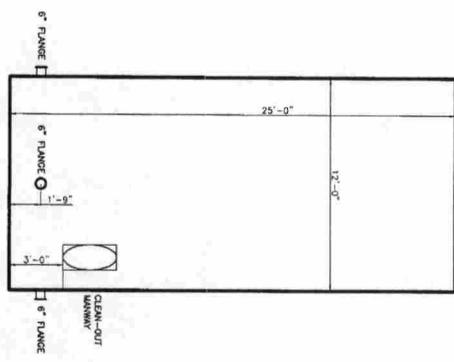
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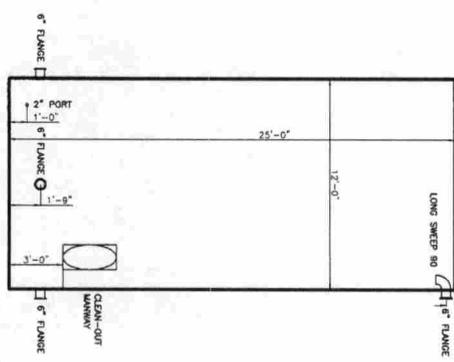
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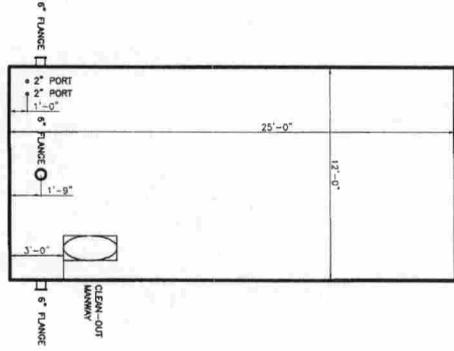
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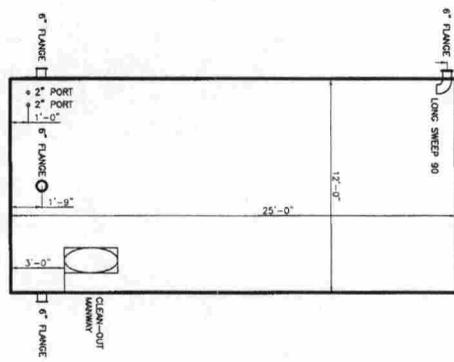
ELEVATION



ELEVATION



ELEVATION



ELEVATION

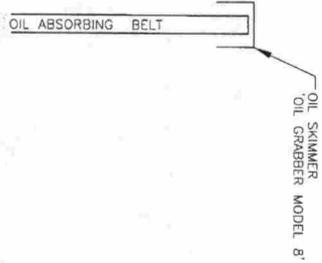
TANK NO. S2, S3, S6, S7, S8,  
S9, S10, S11, S14, S15, S16

TANK NO. S4, S5, S12, S13

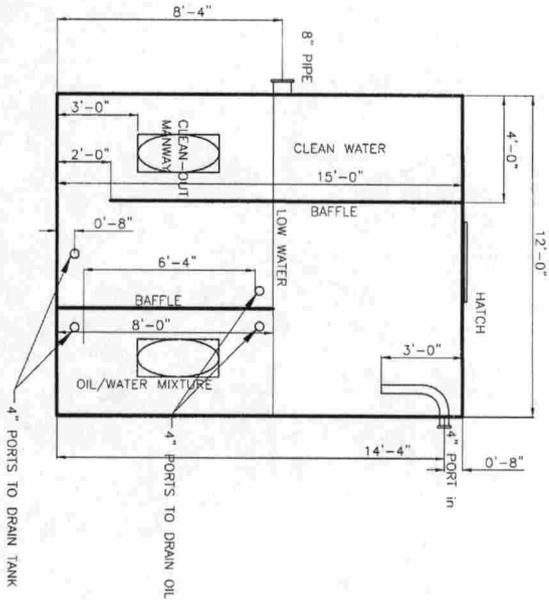
TANK NO. S1

TANK NO. C1

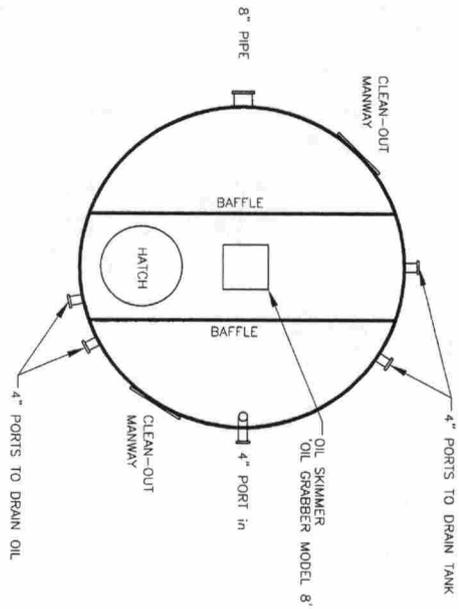
22.5 FT EFFECTIVE STORAGE  
450 BBLS EFFECTIVE STORAGE

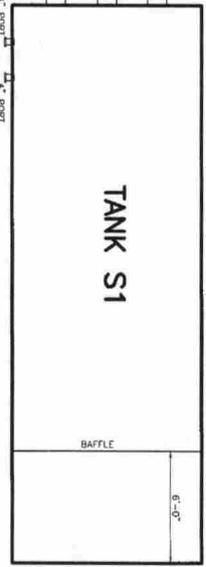
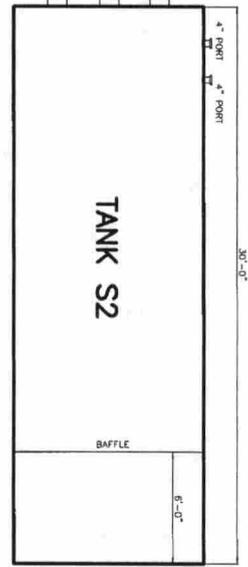
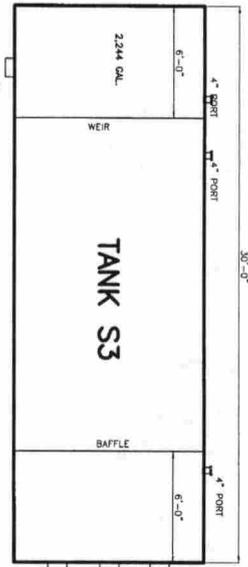


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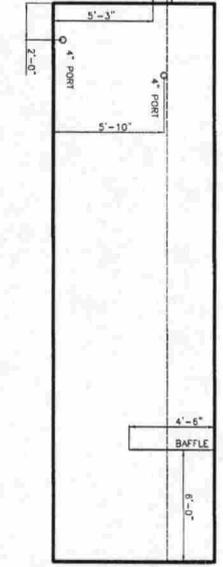
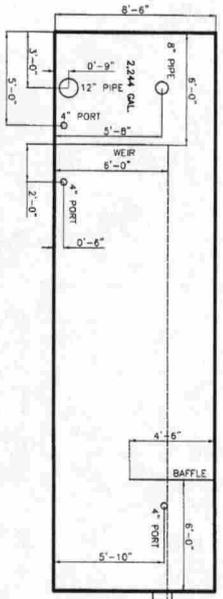
**PLAN VIEW**





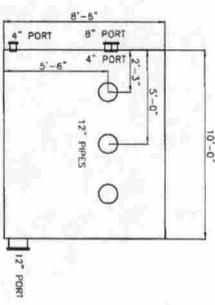
PLAN VIEW

PLAN VIEW



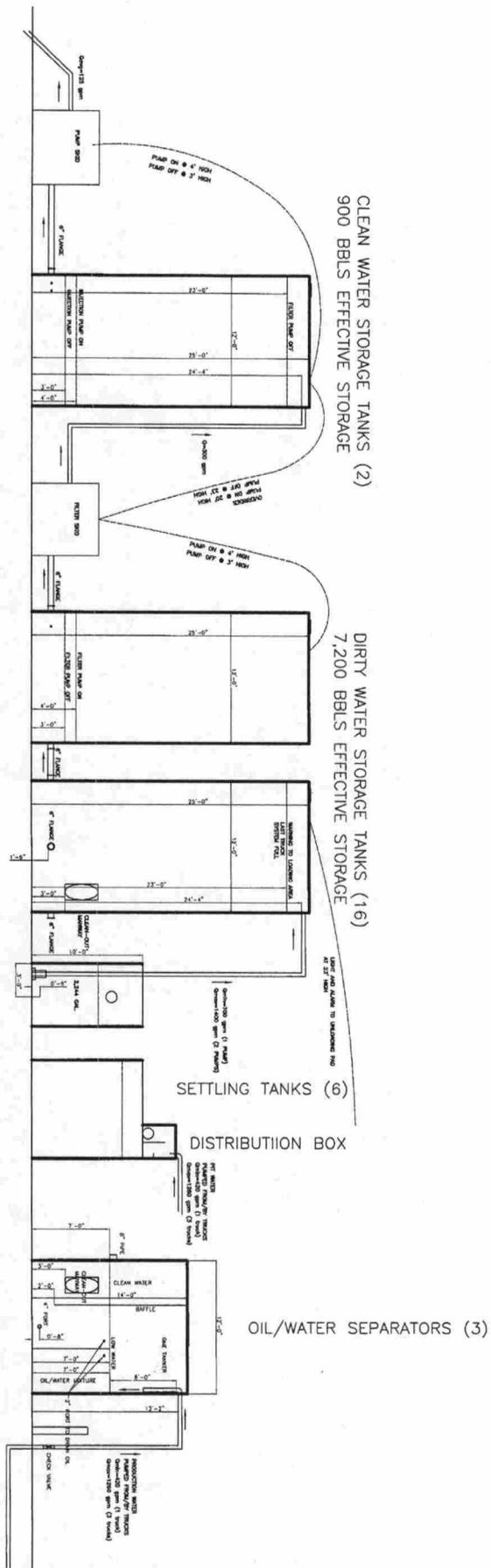
ELEVATION SIDE

ELEVATION SIDE



ELEVATION ENDS

SETTLING TANKS



CLEAN WATER STORAGE TANKS (2)  
900 BBLs EFFECTIVE STORAGE

DIRTY WATER STORAGE TANKS (16)  
7,200 BBLs EFFECTIVE STORAGE

SETTLING TANKS (6)

DISTRIBUTION BOX

OIL/WATER SEPARATORS (3)



*Rexecution = On Time, On Target, On Budget*

476 Rolling Ridge Drive  
Suite 300  
State College, PA 16801  
Ph: 814.278.7267  
Fax: 814.278.7286  
[www.rexenergy.com](http://www.rexenergy.com)

February 15, 2012

Mr. Tom Tomastik, Geologist  
Ohio Department of Natural Resources  
2045 Morse Road, Building H-3  
Columbus, Ohio 43229-6693

RE: Well Completion Record Report for Northstar Khalil Well #3

Dear Mr. Tomastik,

Please find enclosed the Well Completion Record Report for the Northstar Khalil Well #3. If you have any questions or comments, please do not hesitate to contact me by e-mail at [sreynolds@rexenergycorp.com](mailto:sreynolds@rexenergycorp.com), or by telephone at 814-278-7149.

Thank you and have a wonderful day.

Sincerely,

Suzanne Reynolds  
Permit Specialist

Enclosure

RECEIVED  
OCT 25 2013  
Division of Oil & Gas  
Columbus

## Pressure Test Report

### COMPANY INFORMATION

Company Name Rex Energy  
Representative Sean Weissert  
Phone  
Fax  
Address

E-Mail Address  
Service Company Parker Energy Services

### WELL INFORMATION

Well Name North Star #3  
Well Location Mahoning Ohio  
Field and Pool  
Status (Oil, Gas, Water, Injection)  
Perforated Intervals  
Mid-point of Perforated Intervals (MPP)  
Drilling Rig Number  
Elevations  
    Kelly Bushing (KB)  
    Casing Flange (CF)  
    KB-CF  
    Ground Level  
Plug Back Total Depth  
Total Depth  
Production Casing  
Production Tubing

### TEST INFORMATION

Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13  
Dead-weight Gauge Tubing Pressure 0  
Dead-weight Gauge Casing Pressure  
Shut-in Date (Duration) 6/9/13  
Date / Time on Bottom  
Date / Time off Bottom

Probe Serial Number  
Probe Offset from End of Tool String  
Run Depth at Probe Pressure Port

### PRESSURE TEST RESULTS

Maximum Recorded Probe Pressure 5624.3 psig  
Maximum Recorded Probe Temperature 149.6 deg F  
Final Buildup Pressure  
Gradient Survey Information  
    Extrapolated Pressure to MPP  
    Final Gradient at Depth  
Job Number



Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

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**PROBE INFORMATION**

Probe Serial Number  
Model  
Pressure  
    Calibrated Pressure Range  
    Accuracy  
    Resolution  
Temperature  
    Calibrated Temperature Range  
    Accuracy  
    Resolution  
Calibration File Used for Reports

**PROGRAMMING DETAILS**

<u>Step</u>	<u>Sample Mode</u>	<u>Period</u>	<u>Duration</u>	<u>Comment</u>
-------------	--------------------	---------------	-----------------	----------------

Program Start Time  
Program End Time  
Total Samples Taken  
Usage for this Test  
Generic Data File Name



<b>Company Name</b>	Rex Energy
<b>Well Name</b>	North Star #3
<b>Type of Test</b>	Build Up
<b>Date(s) of Test</b>	6/9/13 - 6/17/13

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## **COMMENTS**

Reported By Brandon Parker

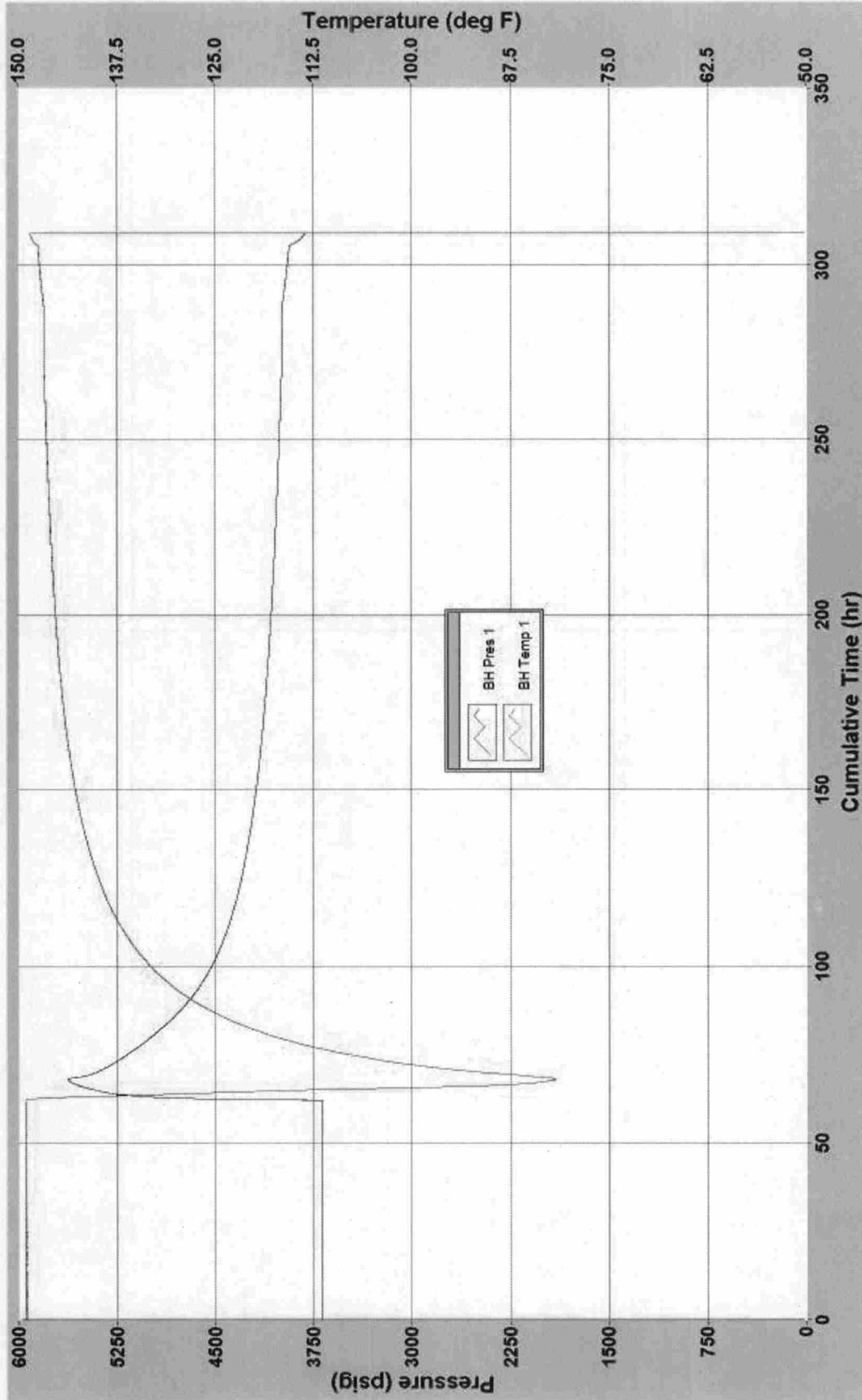
RIH with gauges on 6/9/13. Set @ 7904' in 5.5" casing

POOH on 6/17/13.



Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

# North Star 3





Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/09	13:38:05	0.0000	14.372	86.884
2013/06/09	14:38:05	1.0000	3684.576	149.027
2013/06/09	15:38:05	2.0000	3684.656	149.027
2013/06/09	16:38:05	3.0000	3684.658	149.027
2013/06/09	17:38:05	4.0000	3684.662	149.034
2013/06/09	18:38:05	5.0000	3684.621	149.027
2013/06/09	19:38:05	6.0000	3684.640	149.036
2013/06/09	20:38:05	7.0000	3684.552	149.023
2013/06/09	21:38:05	8.0000	3684.555	149.022
2013/06/09	22:38:05	9.0000	3684.574	149.034
2013/06/09	23:38:05	10.0000	3684.525	149.029
2013/06/10	00:38:05	11.0000	3684.535	149.031
2013/06/10	01:38:05	12.0000	3684.476	149.027
2013/06/10	02:38:05	13.0000	3684.474	149.027
2013/06/10	03:38:05	14.0000	3684.467	149.036
2013/06/10	04:38:05	15.0000	3684.451	149.034
2013/06/10	05:38:05	16.0000	3684.409	149.034
2013/06/10	06:38:05	17.0000	3684.382	149.031
2013/06/10	07:38:05	18.0000	3684.337	149.025
2013/06/10	08:38:05	19.0000	3684.332	149.029
2013/06/10	09:38:05	20.0000	3684.348	149.032
2013/06/10	10:38:05	21.0000	3684.302	149.032
2013/06/10	11:38:05	22.0000	3684.302	149.034
2013/06/10	12:38:05	23.0000	3684.259	149.023
2013/06/10	13:38:05	24.0000	3684.238	149.029
2013/06/10	14:38:05	25.0000	3684.229	149.032
2013/06/10	15:38:05	26.0000	3684.179	149.029
2013/06/10	16:38:05	27.0000	3684.202	149.036
2013/06/10	17:38:05	28.0000	3684.145	149.032
2013/06/10	18:38:05	29.0000	3684.156	149.032
2013/06/10	19:38:05	30.0000	3684.119	149.032
2013/06/10	20:38:05	31.0000	3684.100	149.034
2013/06/10	21:38:05	32.0000	3684.060	149.025
2013/06/10	22:38:05	33.0000	3684.048	149.032
2013/06/10	23:38:05	34.0000	3684.041	149.034
2013/06/11	00:38:05	35.0000	3683.999	149.027
2013/06/11	01:38:05	36.0000	3683.973	149.031
2013/06/11	02:38:05	37.0000	3683.984	149.032
2013/06/11	03:38:05	38.0000	3683.966	149.040
2013/06/11	04:38:05	39.0000	3683.920	149.027
2013/06/11	05:38:05	40.0000	3683.902	149.029
2013/06/11	06:38:05	41.0000	3683.900	149.038
2013/06/11	07:38:05	42.0000	3683.851	149.031
2013/06/11	08:38:05	43.0000	3683.852	149.034
2013/06/11	09:38:05	44.0000	3683.835	149.036
2013/06/11	10:38:05	45.0000	3683.826	149.040
2013/06/11	11:38:05	46.0000	3683.768	149.031
2013/06/11	12:38:05	47.0000	3683.769	149.036
2013/06/11	13:38:05	48.0000	3683.724	149.032
2013/06/11	14:38:05	49.0000	3683.730	149.038
2013/06/11	15:38:05	50.0000	3683.712	149.036
2013/06/11	16:38:05	51.0000	3683.673	149.034
2013/06/11	17:38:05	52.0000	3683.649	149.029
2013/06/11	18:38:05	53.0000	3683.606	149.029

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/11	19:38:05	54.0000	3683.602	149.027
2013/06/11	20:38:05	55.0000	3683.583	149.027
2013/06/11	21:38:05	56.0000	3683.566	149.029
2013/06/11	22:38:05	57.0000	3683.535	149.027
2013/06/11	23:38:05	58.0000	3683.538	149.032
2013/06/12	00:38:05	59.0000	3683.529	149.032
2013/06/12	01:38:05	60.0000	3683.523	149.036
2013/06/12	02:38:05	61.0000	3683.488	149.032
2013/06/12	03:38:05	62.0000	3683.444	149.029
2013/06/12	04:38:05	63.0000	4993.754	143.182
2013/06/12	05:38:05	64.0000	5298.398	128.129
2013/06/12	06:38:05	65.0000	5422.578	113.338
2013/06/12	07:38:05	66.0000	5525.358	93.247
2013/06/12	08:38:05	67.0000	5594.818	84.394
2013/06/12	09:38:05	68.0000	5622.039	81.691
2013/06/12	10:38:05	69.0000	5487.385	85.816
2013/06/12	11:38:05	70.0000	5409.545	91.540
2013/06/12	12:38:05	71.0000	5352.696	95.871
2013/06/12	13:38:05	72.0000	5304.123	99.680
2013/06/12	14:38:05	73.0000	5259.618	102.920
2013/06/12	15:38:05	74.0000	5216.576	105.501
2013/06/12	16:38:05	75.0000	5175.878	107.980
2013/06/12	17:38:05	76.0000	5136.644	110.341
2013/06/12	18:38:05	77.0000	5098.815	112.410
2013/06/12	19:38:05	78.0000	5062.527	114.202
2013/06/12	20:38:05	79.0000	5027.531	115.740
2013/06/12	21:38:05	80.0000	4993.439	117.372
2013/06/12	22:38:05	81.0000	4960.281	118.789
2013/06/12	23:38:05	82.0000	4928.075	120.105
2013/06/13	00:38:05	83.0000	4896.675	121.260
2013/06/13	01:38:05	84.0000	4866.475	122.400
2013/06/13	02:38:05	85.0000	4837.408	123.420
2013/06/13	03:38:05	86.0000	4809.478	124.372
2013/06/13	04:38:05	87.0000	4782.687	125.283
2013/06/13	05:38:05	88.0000	4757.136	126.142
2013/06/13	06:38:05	89.0000	4732.708	126.957
2013/06/13	07:38:05	90.0000	4709.379	127.670
2013/06/13	08:38:05	91.0000	4687.350	128.401
2013/06/13	09:38:05	92.0000	4666.252	129.106
2013/06/13	10:38:05	93.0000	4646.020	129.704
2013/06/13	11:38:05	94.0000	4626.887	130.320
2013/06/13	12:38:05	95.0000	4608.743	130.872
2013/06/13	13:38:05	96.0000	4591.286	131.409
2013/06/13	14:38:05	97.0000	4574.549	131.931
2013/06/13	15:38:05	98.0000	4558.759	132.426
2013/06/13	16:38:05	99.0000	4543.596	132.865
2013/06/13	17:38:05	100.0000	4529.224	133.320
2013/06/13	18:38:05	101.0000	4515.365	133.723
2013/06/13	19:38:05	102.0000	4502.095	134.123
2013/06/13	20:38:05	103.0000	4489.377	134.496
2013/06/13	21:38:05	104.0000	4477.216	134.874
2013/06/13	22:38:05	105.0000	4465.494	135.217
2013/06/13	23:38:05	106.0000	4454.223	135.554
2013/06/14	00:38:05	107.0000	4443.436	135.873



Company Name Rex Energy  
 Well Name North Star #3  
 Type of Test Build Up  
 Date(s) of Test 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/14	01:38:05	108.0000	4433.101	136.191
2013/06/14	02:38:05	109.0000	4423.010	136.474
2013/06/14	03:38:05	110.0000	4413.363	136.742
2013/06/14	04:38:05	111.0000	4404.032	137.026
2013/06/14	05:38:05	112.0000	4395.092	137.287
2013/06/14	06:38:05	113.0000	4386.418	137.550
2013/06/14	07:38:05	114.0000	4377.979	137.777
2013/06/14	08:38:05	115.0000	4369.847	138.013
2013/06/14	09:38:05	116.0000	4362.061	138.245
2013/06/14	10:38:05	117.0000	4354.453	138.447
2013/06/14	11:38:05	118.0000	4347.064	138.664
2013/06/14	12:38:05	119.0000	4339.866	138.862
2013/06/14	13:38:05	120.0000	4332.945	139.048
2013/06/14	14:38:05	121.0000	4326.288	139.239
2013/06/14	15:38:05	122.0000	4319.725	139.429
2013/06/14	16:38:05	123.0000	4313.374	139.595
2013/06/14	17:38:05	124.0000	4307.218	139.780
2013/06/14	18:38:05	125.0000	4301.208	139.937
2013/06/14	19:38:05	126.0000	4295.362	140.094
2013/06/14	20:38:05	127.0000	4289.689	140.245
2013/06/14	21:38:05	128.0000	4284.109	140.410
2013/06/14	22:38:05	129.0000	4278.749	140.547
2013/06/14	23:38:05	130.0000	4273.497	140.688
2013/06/15	00:38:05	131.0000	4268.350	140.819
2013/06/15	01:38:05	132.0000	4263.374	140.965
2013/06/15	02:38:05	133.0000	4258.465	141.073
2013/06/15	03:38:05	134.0000	4253.851	141.215
2013/06/15	04:38:05	135.0000	4249.049	141.334
2013/06/15	05:38:05	136.0000	4244.545	141.453
2013/06/15	06:38:05	137.0000	4239.989	141.564
2013/06/15	07:38:05	138.0000	4235.701	141.674
2013/06/15	08:38:05	139.0000	4231.481	141.777
2013/06/15	09:38:05	140.0000	4227.345	141.894
2013/06/15	10:38:05	141.0000	4223.297	142.003
2013/06/15	11:38:05	142.0000	4219.289	142.097
2013/06/15	12:38:05	143.0000	4215.394	142.205
2013/06/15	13:38:05	144.0000	4211.541	142.281
2013/06/15	14:38:05	145.0000	4207.859	142.383
2013/06/15	15:38:05	146.0000	4204.131	142.471
2013/06/15	16:38:05	147.0000	4200.566	142.560
2013/06/15	17:38:05	148.0000	4197.031	142.644
2013/06/15	18:38:05	149.0000	4193.576	142.731
2013/06/15	19:38:05	150.0000	4190.224	142.817
2013/06/15	20:38:05	151.0000	4186.887	142.903
2013/06/15	21:38:05	152.0000	4183.684	142.990
2013/06/15	22:38:05	153.0000	4180.362	143.049
2013/06/15	23:38:05	154.0000	4177.234	143.125
2013/06/16	00:38:05	155.0000	4174.153	143.190
2013/06/16	01:38:05	156.0000	4171.125	143.267
2013/06/16	02:38:05	157.0000	4168.164	143.337
2013/06/16	03:38:05	158.0000	4165.249	143.406
2013/06/16	04:38:05	159.0000	4162.363	143.472
2013/06/16	05:38:05	160.0000	4159.479	143.532
2013/06/16	06:38:05	161.0000	4156.735	143.604

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/16	07:38:05	162.0000	4153.967	143.658
2013/06/16	08:38:05	163.0000	4151.334	143.731
2013/06/16	09:38:05	164.0000	4148.606	143.785
2013/06/16	10:38:05	165.0000	4146.097	143.854
2013/06/16	11:38:05	166.0000	4143.503	143.911
2013/06/16	12:38:05	167.0000	4140.955	143.958
2013/06/16	13:38:05	168.0000	4138.513	144.023
2013/06/16	14:38:05	169.0000	4136.044	144.066
2013/06/16	15:38:05	170.0000	4133.641	144.120
2013/06/16	16:38:05	171.0000	4131.321	144.178
2013/06/16	17:38:05	172.0000	4128.926	144.225
2013/06/16	18:38:05	173.0000	4126.625	144.270
2013/06/16	19:38:05	174.0000	4124.366	144.325
2013/06/16	20:38:05	175.0000	4122.151	144.369
2013/06/16	21:38:05	176.0000	4119.970	144.421
2013/06/16	22:38:05	177.0000	4117.770	144.462
2013/06/16	23:38:05	178.0000	4115.640	144.505
2013/06/17	00:38:05	179.0000	4113.537	144.550
2013/06/17	01:38:05	180.0000	4111.454	144.592
2013/06/17	02:38:05	181.0000	4109.396	144.633
2013/06/17	03:38:05	182.0000	4107.413	144.675
2013/06/17	04:38:05	183.0000	4105.409	144.718
2013/06/17	05:38:05	184.0000	4103.453	144.761
2013/06/17	06:38:05	185.0000	4101.502	144.799
2013/06/17	07:38:05	186.0000	4099.554	144.838
2013/06/17	08:38:05	187.0000	4097.662	144.871
2013/06/17	09:38:05	188.0000	4095.791	144.909
2013/06/17	10:38:05	189.0000	4093.934	144.950
2013/06/17	11:38:05	190.0000	4092.158	144.984
2013/06/17	12:38:05	191.0000	4090.350	145.027
2013/06/17	13:38:05	192.0000	4088.604	145.062
2013/06/17	14:38:05	193.0000	4086.840	145.098
2013/06/17	15:38:05	194.0000	4085.081	145.130
2013/06/17	16:38:05	195.0000	4083.383	145.161
2013/06/17	17:38:05	196.0000	4081.660	145.191
2013/06/17	18:38:05	197.0000	4079.996	145.220
2013/06/17	19:38:05	198.0000	4078.353	145.258
2013/06/17	20:38:05	199.0000	4076.714	145.287
2013/06/17	21:38:05	200.0000	4075.095	145.317
2013/06/17	22:38:05	201.0000	4073.508	145.353
2013/06/17	23:38:05	202.0000	4071.939	145.386
2013/06/18	00:38:05	203.0000	4070.388	145.414
2013/06/18	01:38:05	204.0000	4068.790	145.436
2013/06/18	02:38:05	205.0000	4067.305	145.472
2013/06/18	03:38:05	206.0000	4065.741	145.494
2013/06/18	04:38:05	207.0000	4064.273	145.524
2013/06/18	05:38:05	208.0000	4062.823	145.555
2013/06/18	06:38:05	209.0000	4061.323	145.584
2013/06/18	07:38:05	210.0000	4059.874	145.602
2013/06/18	08:38:05	211.0000	4058.475	145.645
2013/06/18	09:38:05	212.0000	4057.030	145.659
2013/06/18	10:38:05	213.0000	4055.594	145.681
2013/06/18	11:38:05	214.0000	4054.260	145.717
2013/06/18	12:38:05	215.0000	4052.872	145.738



**Company Name** Rex Energy  
**Well Name** North Star #3  
**Type of Test** Build Up  
**Date(s) of Test** 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/18	13:38:05	216.0000	4051.480	145.758
2013/06/18	14:38:05	217.0000	4050.111	145.780
2013/06/18	15:38:05	218.0000	4048.829	145.816
2013/06/18	16:38:05	219.0000	4047.511	145.834
2013/06/18	17:38:05	220.0000	4046.228	145.861
2013/06/18	18:38:05	221.0000	4044.887	145.875
2013/06/18	19:38:05	222.0000	4043.576	145.890
2013/06/18	20:38:05	223.0000	4042.344	145.920
2013/06/18	21:38:05	224.0000	4041.086	145.949
2013/06/18	22:38:05	225.0000	4039.759	145.965
2013/06/18	23:38:05	226.0000	4038.466	145.983
2013/06/19	00:38:05	227.0000	4037.223	146.001
2013/06/19	01:38:05	228.0000	4036.000	146.026
2013/06/19	02:38:05	229.0000	4034.786	146.050
2013/06/19	03:38:05	230.0000	4033.580	146.070
2013/06/19	04:38:05	231.0000	4032.409	146.088
2013/06/19	05:38:05	232.0000	4031.230	146.107
2013/06/19	06:38:05	233.0000	4030.054	146.120
2013/06/19	07:38:05	234.0000	4028.930	146.147
2013/06/19	08:38:05	235.0000	4027.797	146.172
2013/06/19	09:38:05	236.0000	4026.692	146.188
2013/06/19	10:38:05	237.0000	4025.546	146.205
2013/06/19	11:38:05	238.0000	4024.458	146.230
2013/06/19	12:38:05	239.0000	4023.340	146.237
2013/06/19	13:38:05	240.0000	4022.299	146.264
2013/06/19	14:38:05	241.0000	4021.197	146.277
2013/06/19	15:38:05	242.0000	4020.134	146.295
2013/06/19	16:38:05	243.0000	4019.087	146.318
2013/06/19	17:38:05	244.0000	4018.021	146.336
2013/06/19	18:38:05	245.0000	4016.974	146.352
2013/06/19	19:38:05	246.0000	4015.938	146.363
2013/06/19	20:38:05	247.0000	4014.916	146.388
2013/06/19	21:38:05	248.0000	4013.878	146.392
2013/06/19	22:38:05	249.0000	4012.933	146.419
2013/06/19	23:38:05	250.0000	4011.924	146.437
2013/06/20	00:38:05	251.0000	4010.938	146.451
2013/06/20	01:38:05	252.0000	4009.936	146.466
2013/06/20	02:38:05	253.0000	4008.972	146.480
2013/06/20	03:38:05	254.0000	4007.958	146.493
2013/06/20	04:38:05	255.0000	4007.060	146.516
2013/06/20	05:38:05	256.0000	4006.097	146.521
2013/06/20	06:38:05	257.0000	4005.167	146.536
2013/06/20	07:38:05	258.0000	4004.219	146.554
2013/06/20	08:38:05	259.0000	4003.320	146.570
2013/06/20	09:38:05	260.0000	4002.343	146.577
2013/06/20	10:38:05	261.0000	4001.457	146.592
2013/06/20	11:38:05	262.0000	4000.550	146.613
2013/06/20	12:38:05	263.0000	3999.625	146.622
2013/06/20	13:38:05	264.0000	3998.730	146.633
2013/06/20	14:38:05	265.0000	3997.902	146.658
2013/06/20	15:38:05	266.0000	3996.969	146.665
2013/06/20	16:38:05	267.0000	3996.073	146.673
2013/06/20	17:38:05	268.0000	3995.225	146.694
2013/06/20	18:38:05	269.0000	3994.324	146.707

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/20	19:38:05	270.0000	3993.526	146.719
2013/06/20	20:38:05	271.0000	3992.627	146.728
2013/06/20	21:38:05	272.0000	3991.794	146.741
2013/06/20	22:38:05	273.0000	3990.944	146.752
2013/06/20	23:38:00	273.9986	3990.887	146.761
2013/06/21	00:38:00	274.9986	3990.845	146.757
2013/06/21	01:43:00	276.0819	3990.842	146.759
2013/06/21	02:43:00	277.0819	3990.825	146.757
2013/06/21	03:43:00	278.0819	3990.820	146.763
2013/06/21	04:38:00	278.9986	3990.834	146.763
2013/06/21	05:38:00	279.9986	3990.748	146.752
2013/06/21	06:43:00	281.0819	3990.786	146.761
2013/06/21	07:43:00	282.0819	3990.772	146.761
2013/06/21	08:43:00	283.0819	3990.741	146.761
2013/06/21	09:38:00	283.9986	3990.712	146.761
2013/06/21	10:38:00	284.9986	3990.746	146.766
2013/06/21	11:38:00	285.9986	3990.703	146.759
2013/06/21	12:43:00	287.0819	3990.688	146.763
2013/06/21	13:38:00	287.9986	3990.689	146.764
2013/06/21	14:38:05	289.0000	3986.954	146.820
2013/06/21	15:38:05	290.0000	3982.982	146.878
2013/06/21	16:38:05	291.0000	3979.093	146.926
2013/06/21	17:38:05	292.0000	3975.451	146.988
2013/06/21	18:38:05	293.0000	3971.866	147.027
2013/06/21	19:38:05	294.0000	3968.400	147.081
2013/06/21	20:38:05	295.0000	3965.107	147.128
2013/06/21	21:38:05	296.0000	3961.863	147.173
2013/06/21	22:38:05	297.0000	3958.714	147.216
2013/06/21	23:38:05	298.0000	3955.670	147.256
2013/06/22	00:38:05	299.0000	3952.713	147.297
2013/06/22	01:38:05	300.0000	3949.775	147.331
2013/06/22	02:38:05	301.0000	3946.928	147.360
2013/06/22	03:38:05	302.0000	3944.199	147.402
2013/06/22	04:38:05	303.0000	3941.508	147.432
2013/06/22	05:38:05	304.0000	3938.906	147.465
2013/06/22	06:38:05	305.0000	3936.384	147.495
2013/06/22	07:38:05	306.0000	3902.823	147.834
2013/06/22	08:38:05	307.0000	3861.414	148.203
2013/06/22	09:38:05	308.0000	3834.122	148.402

# Pressure Test Report

## COMPANY INFORMATION

Company Name Rex Energy  
Representative Sean Weissert  
Phone  
Fax  
Address

E-Mail Address  
Service Company Parker Energy Services

## WELL INFORMATION

Well Name North Star #3  
Well Location Mahoning Ohio  
Field and Pool  
Status (Oil, Gas, Water, Injection)  
Perforated Intervals  
Mid-point of Perforated Intervals (MPP)  
Drilling Rig Number  
Elevations  
    Kelly Bushing (KB)  
    Casing Flange (CF)  
    KB-CF  
    Ground Level  
Plug Back Total Depth  
Total Depth  
Production Casing  
Production Tubing

## TEST INFORMATION

Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13  
Dead-weight Gauge Tubing Pressure 0  
Dead-weight Gauge Casing Pressure  
Shut-in Date (Duration) 6/9/13  
Date / Time on Bottom  
Date / Time off Bottom

Probe Serial Number  
Probe Offset from End of Tool String  
Run Depth at Probe Pressure Port

## PRESSURE TEST RESULTS

Maximum Recorded Probe Pressure 5624.3 psig  
Maximum Recorded Probe Temperature 149.6 deg F  
Final Buildup Pressure  
Gradient Survey Information  
    Extrapolated Pressure to MPP  
    Final Gradient at Depth  
Job Number



Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

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**PROBE INFORMATION**

Probe Serial Number  
Model  
Pressure  
    Calibrated Pressure Range  
    Accuracy  
    Resolution  
Temperature  
    Calibrated Temperature Range  
    Accuracy  
    Resolution  
Calibration File Used for Reports

**PROGRAMMING DETAILS**

<u>Step</u>	<u>Sample Mode</u>	<u>Period</u>	<u>Duration</u>	<u>Comment</u>
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Program Start Time  
Program End Time  
Total Samples Taken  
Usage for this Test  
Generic Data File Name



<b>Company Name</b>	Rex Energy
<b>Well Name</b>	North Star #3
<b>Type of Test</b>	Build Up
<b>Date(s) of Test</b>	6/9/13 - 6/17/13

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## **COMMENTS**

Reported By Brandon Parker

RIH with gauges on 6/9/13. Set @ 7904' in 5.5" casing

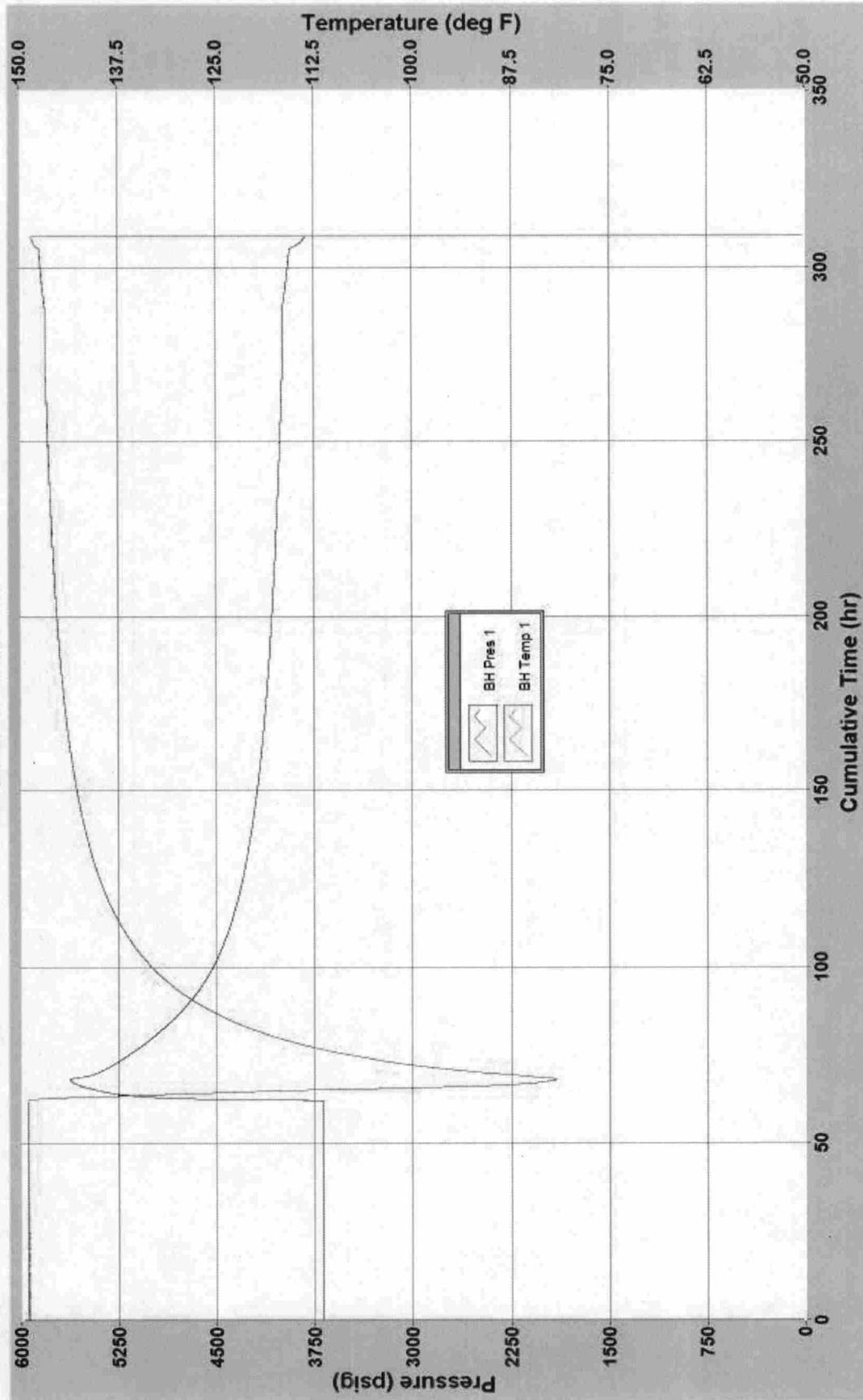
POOH on 6/17/13.



Company Name  
Well Name  
Type of Test  
Date(s) of Test

Rex Energy  
North Star #3  
Build Up  
6/9/13 - 6/17/13

# North Star 3





Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/09	13:38:05	0.0000	14.372	86.884
2013/06/09	14:38:05	1.0000	3684.576	149.027
2013/06/09	15:38:05	2.0000	3684.656	149.027
2013/06/09	16:38:05	3.0000	3684.658	149.027
2013/06/09	17:38:05	4.0000	3684.662	149.034
2013/06/09	18:38:05	5.0000	3684.621	149.027
2013/06/09	19:38:05	6.0000	3684.640	149.036
2013/06/09	20:38:05	7.0000	3684.552	149.023
2013/06/09	21:38:05	8.0000	3684.555	149.022
2013/06/09	22:38:05	9.0000	3684.574	149.034
2013/06/09	23:38:05	10.0000	3684.525	149.029
2013/06/10	00:38:05	11.0000	3684.535	149.031
2013/06/10	01:38:05	12.0000	3684.476	149.027
2013/06/10	02:38:05	13.0000	3684.474	149.027
2013/06/10	03:38:05	14.0000	3684.467	149.036
2013/06/10	04:38:05	15.0000	3684.451	149.034
2013/06/10	05:38:05	16.0000	3684.409	149.034
2013/06/10	06:38:05	17.0000	3684.382	149.031
2013/06/10	07:38:05	18.0000	3684.337	149.025
2013/06/10	08:38:05	19.0000	3684.332	149.029
2013/06/10	09:38:05	20.0000	3684.348	149.032
2013/06/10	10:38:05	21.0000	3684.302	149.032
2013/06/10	11:38:05	22.0000	3684.302	149.034
2013/06/10	12:38:05	23.0000	3684.259	149.023
2013/06/10	13:38:05	24.0000	3684.238	149.029
2013/06/10	14:38:05	25.0000	3684.229	149.032
2013/06/10	15:38:05	26.0000	3684.179	149.029
2013/06/10	16:38:05	27.0000	3684.202	149.036
2013/06/10	17:38:05	28.0000	3684.145	149.032
2013/06/10	18:38:05	29.0000	3684.156	149.032
2013/06/10	19:38:05	30.0000	3684.119	149.032
2013/06/10	20:38:05	31.0000	3684.100	149.034
2013/06/10	21:38:05	32.0000	3684.060	149.025
2013/06/10	22:38:05	33.0000	3684.048	149.032
2013/06/10	23:38:05	34.0000	3684.041	149.034
2013/06/11	00:38:05	35.0000	3683.999	149.027
2013/06/11	01:38:05	36.0000	3683.973	149.031
2013/06/11	02:38:05	37.0000	3683.984	149.032
2013/06/11	03:38:05	38.0000	3683.966	149.040
2013/06/11	04:38:05	39.0000	3683.920	149.027
2013/06/11	05:38:05	40.0000	3683.902	149.029
2013/06/11	06:38:05	41.0000	3683.900	149.038
2013/06/11	07:38:05	42.0000	3683.851	149.031
2013/06/11	08:38:05	43.0000	3683.852	149.034
2013/06/11	09:38:05	44.0000	3683.835	149.036
2013/06/11	10:38:05	45.0000	3683.826	149.040
2013/06/11	11:38:05	46.0000	3683.768	149.031
2013/06/11	12:38:05	47.0000	3683.769	149.036
2013/06/11	13:38:05	48.0000	3683.724	149.032
2013/06/11	14:38:05	49.0000	3683.730	149.038
2013/06/11	15:38:05	50.0000	3683.712	149.036
2013/06/11	16:38:05	51.0000	3683.673	149.034
2013/06/11	17:38:05	52.0000	3683.649	149.029
2013/06/11	18:38:05	53.0000	3683.606	149.029

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/11	19:38:05	54.0000	3683.602	149.027
2013/06/11	20:38:05	55.0000	3683.583	149.027
2013/06/11	21:38:05	56.0000	3683.566	149.029
2013/06/11	22:38:05	57.0000	3683.535	149.027
2013/06/11	23:38:05	58.0000	3683.538	149.032
2013/06/12	00:38:05	59.0000	3683.529	149.032
2013/06/12	01:38:05	60.0000	3683.523	149.036
2013/06/12	02:38:05	61.0000	3683.488	149.032
2013/06/12	03:38:05	62.0000	3683.444	149.029
2013/06/12	04:38:05	63.0000	4993.754	143.182
2013/06/12	05:38:05	64.0000	5298.398	128.129
2013/06/12	06:38:05	65.0000	5422.578	113.338
2013/06/12	07:38:05	66.0000	5525.358	93.247
2013/06/12	08:38:05	67.0000	5594.818	84.394
2013/06/12	09:38:05	68.0000	5622.039	81.691
2013/06/12	10:38:05	69.0000	5487.385	85.816
2013/06/12	11:38:05	70.0000	5409.545	91.540
2013/06/12	12:38:05	71.0000	5352.696	95.871
2013/06/12	13:38:05	72.0000	5304.123	99.680
2013/06/12	14:38:05	73.0000	5259.618	102.920
2013/06/12	15:38:05	74.0000	5216.576	105.501
2013/06/12	16:38:05	75.0000	5175.878	107.980
2013/06/12	17:38:05	76.0000	5136.644	110.341
2013/06/12	18:38:05	77.0000	5098.815	112.410
2013/06/12	19:38:05	78.0000	5062.527	114.202
2013/06/12	20:38:05	79.0000	5027.531	115.740
2013/06/12	21:38:05	80.0000	4993.439	117.372
2013/06/12	22:38:05	81.0000	4960.281	118.789
2013/06/12	23:38:05	82.0000	4928.075	120.105
2013/06/13	00:38:05	83.0000	4896.675	121.260
2013/06/13	01:38:05	84.0000	4866.475	122.400
2013/06/13	02:38:05	85.0000	4837.408	123.420
2013/06/13	03:38:05	86.0000	4809.478	124.372
2013/06/13	04:38:05	87.0000	4782.687	125.283
2013/06/13	05:38:05	88.0000	4757.136	126.142
2013/06/13	06:38:05	89.0000	4732.708	126.957
2013/06/13	07:38:05	90.0000	4709.379	127.670
2013/06/13	08:38:05	91.0000	4687.350	128.401
2013/06/13	09:38:05	92.0000	4666.252	129.106
2013/06/13	10:38:05	93.0000	4646.020	129.704
2013/06/13	11:38:05	94.0000	4626.887	130.320
2013/06/13	12:38:05	95.0000	4608.743	130.872
2013/06/13	13:38:05	96.0000	4591.286	131.409
2013/06/13	14:38:05	97.0000	4574.549	131.931
2013/06/13	15:38:05	98.0000	4558.759	132.426
2013/06/13	16:38:05	99.0000	4543.596	132.865
2013/06/13	17:38:05	100.0000	4529.224	133.320
2013/06/13	18:38:05	101.0000	4515.365	133.723
2013/06/13	19:38:05	102.0000	4502.095	134.123
2013/06/13	20:38:05	103.0000	4489.377	134.496
2013/06/13	21:38:05	104.0000	4477.216	134.874
2013/06/13	22:38:05	105.0000	4465.494	135.217
2013/06/13	23:38:05	106.0000	4454.223	135.554
2013/06/14	00:38:05	107.0000	4443.436	135.873



Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/14	01:38:05	108.0000	4433.101	136.191
2013/06/14	02:38:05	109.0000	4423.010	136.474
2013/06/14	03:38:05	110.0000	4413.363	136.742
2013/06/14	04:38:05	111.0000	4404.032	137.026
2013/06/14	05:38:05	112.0000	4395.092	137.287
2013/06/14	06:38:05	113.0000	4386.418	137.550
2013/06/14	07:38:05	114.0000	4377.979	137.777
2013/06/14	08:38:05	115.0000	4369.847	138.013
2013/06/14	09:38:05	116.0000	4362.061	138.245
2013/06/14	10:38:05	117.0000	4354.453	138.447
2013/06/14	11:38:05	118.0000	4347.064	138.664
2013/06/14	12:38:05	119.0000	4339.866	138.862
2013/06/14	13:38:05	120.0000	4332.945	139.048
2013/06/14	14:38:05	121.0000	4326.288	139.239
2013/06/14	15:38:05	122.0000	4319.725	139.429
2013/06/14	16:38:05	123.0000	4313.374	139.595
2013/06/14	17:38:05	124.0000	4307.218	139.780
2013/06/14	18:38:05	125.0000	4301.208	139.937
2013/06/14	19:38:05	126.0000	4295.362	140.094
2013/06/14	20:38:05	127.0000	4289.689	140.245
2013/06/14	21:38:05	128.0000	4284.109	140.410
2013/06/14	22:38:05	129.0000	4278.749	140.547
2013/06/14	23:38:05	130.0000	4273.497	140.688
2013/06/15	00:38:05	131.0000	4268.350	140.819
2013/06/15	01:38:05	132.0000	4263.374	140.965
2013/06/15	02:38:05	133.0000	4258.465	141.073
2013/06/15	03:38:05	134.0000	4253.851	141.215
2013/06/15	04:38:05	135.0000	4249.049	141.334
2013/06/15	05:38:05	136.0000	4244.545	141.453
2013/06/15	06:38:05	137.0000	4239.989	141.564
2013/06/15	07:38:05	138.0000	4235.701	141.674
2013/06/15	08:38:05	139.0000	4231.481	141.777
2013/06/15	09:38:05	140.0000	4227.345	141.894
2013/06/15	10:38:05	141.0000	4223.297	142.003
2013/06/15	11:38:05	142.0000	4219.289	142.097
2013/06/15	12:38:05	143.0000	4215.394	142.205
2013/06/15	13:38:05	144.0000	4211.541	142.281
2013/06/15	14:38:05	145.0000	4207.859	142.383
2013/06/15	15:38:05	146.0000	4204.131	142.471
2013/06/15	16:38:05	147.0000	4200.566	142.560
2013/06/15	17:38:05	148.0000	4197.031	142.644
2013/06/15	18:38:05	149.0000	4193.576	142.731
2013/06/15	19:38:05	150.0000	4190.224	142.817
2013/06/15	20:38:05	151.0000	4186.887	142.903
2013/06/15	21:38:05	152.0000	4183.684	142.990
2013/06/15	22:38:05	153.0000	4180.362	143.049
2013/06/15	23:38:05	154.0000	4177.234	143.125
2013/06/16	00:38:05	155.0000	4174.153	143.190
2013/06/16	01:38:05	156.0000	4171.125	143.267
2013/06/16	02:38:05	157.0000	4168.164	143.337
2013/06/16	03:38:05	158.0000	4165.249	143.406
2013/06/16	04:38:05	159.0000	4162.363	143.472
2013/06/16	05:38:05	160.0000	4159.479	143.532
2013/06/16	06:38:05	161.0000	4156.735	143.604

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/16	07:38:05	162.0000	4153.967	143.658
2013/06/16	08:38:05	163.0000	4151.334	143.731
2013/06/16	09:38:05	164.0000	4148.606	143.785
2013/06/16	10:38:05	165.0000	4146.097	143.854
2013/06/16	11:38:05	166.0000	4143.503	143.911
2013/06/16	12:38:05	167.0000	4140.955	143.958
2013/06/16	13:38:05	168.0000	4138.513	144.023
2013/06/16	14:38:05	169.0000	4136.044	144.066
2013/06/16	15:38:05	170.0000	4133.641	144.120
2013/06/16	16:38:05	171.0000	4131.321	144.178
2013/06/16	17:38:05	172.0000	4128.926	144.225
2013/06/16	18:38:05	173.0000	4126.625	144.270
2013/06/16	19:38:05	174.0000	4124.366	144.325
2013/06/16	20:38:05	175.0000	4122.151	144.369
2013/06/16	21:38:05	176.0000	4119.970	144.421
2013/06/16	22:38:05	177.0000	4117.770	144.462
2013/06/16	23:38:05	178.0000	4115.640	144.505
2013/06/17	00:38:05	179.0000	4113.537	144.550
2013/06/17	01:38:05	180.0000	4111.454	144.592
2013/06/17	02:38:05	181.0000	4109.396	144.633
2013/06/17	03:38:05	182.0000	4107.413	144.675
2013/06/17	04:38:05	183.0000	4105.409	144.718
2013/06/17	05:38:05	184.0000	4103.453	144.761
2013/06/17	06:38:05	185.0000	4101.502	144.799
2013/06/17	07:38:05	186.0000	4099.554	144.838
2013/06/17	08:38:05	187.0000	4097.662	144.871
2013/06/17	09:38:05	188.0000	4095.791	144.909
2013/06/17	10:38:05	189.0000	4093.934	144.950
2013/06/17	11:38:05	190.0000	4092.158	144.984
2013/06/17	12:38:05	191.0000	4090.350	145.027
2013/06/17	13:38:05	192.0000	4088.604	145.062
2013/06/17	14:38:05	193.0000	4086.840	145.098
2013/06/17	15:38:05	194.0000	4085.081	145.130
2013/06/17	16:38:05	195.0000	4083.383	145.161
2013/06/17	17:38:05	196.0000	4081.660	145.191
2013/06/17	18:38:05	197.0000	4079.996	145.220
2013/06/17	19:38:05	198.0000	4078.353	145.258
2013/06/17	20:38:05	199.0000	4076.714	145.287
2013/06/17	21:38:05	200.0000	4075.095	145.317
2013/06/17	22:38:05	201.0000	4073.508	145.353
2013/06/17	23:38:05	202.0000	4071.939	145.386
2013/06/18	00:38:05	203.0000	4070.388	145.414
2013/06/18	01:38:05	204.0000	4068.790	145.436
2013/06/18	02:38:05	205.0000	4067.305	145.472
2013/06/18	03:38:05	206.0000	4065.741	145.494
2013/06/18	04:38:05	207.0000	4064.273	145.524
2013/06/18	05:38:05	208.0000	4062.823	145.555
2013/06/18	06:38:05	209.0000	4061.323	145.584
2013/06/18	07:38:05	210.0000	4059.874	145.602
2013/06/18	08:38:05	211.0000	4058.475	145.645
2013/06/18	09:38:05	212.0000	4057.030	145.659
2013/06/18	10:38:05	213.0000	4055.594	145.681
2013/06/18	11:38:05	214.0000	4054.260	145.717
2013/06/18	12:38:05	215.0000	4052.872	145.738

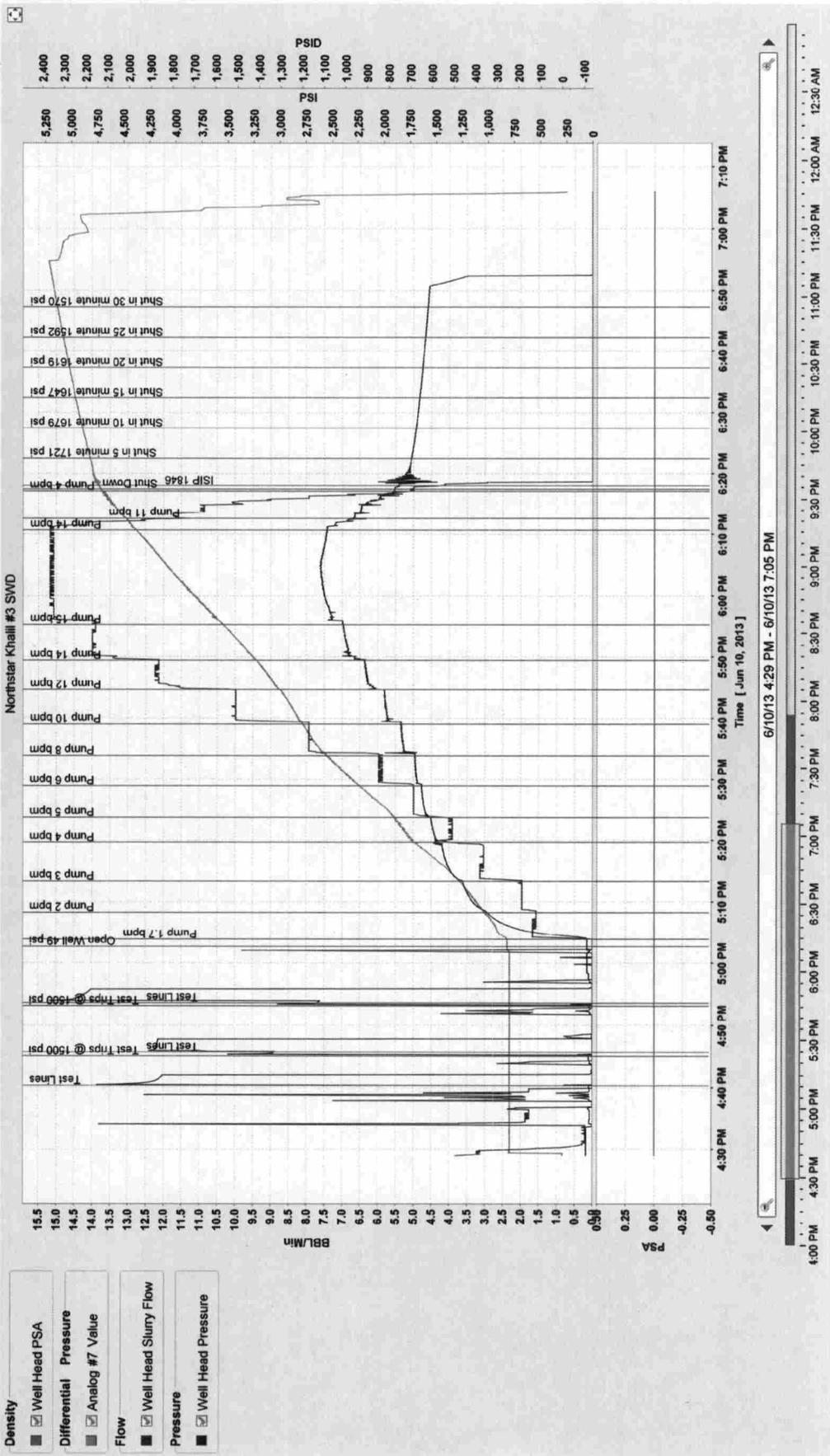


Company Name Rex Energy  
Well Name North Star #3  
Type of Test Build Up  
Date(s) of Test 6/9/13 - 6/17/13

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/18	13:38:05	216.0000	4051.480	145.758
2013/06/18	14:38:05	217.0000	4050.111	145.780
2013/06/18	15:38:05	218.0000	4048.829	145.816
2013/06/18	16:38:05	219.0000	4047.511	145.834
2013/06/18	17:38:05	220.0000	4046.228	145.861
2013/06/18	18:38:05	221.0000	4044.887	145.875
2013/06/18	19:38:05	222.0000	4043.576	145.890
2013/06/18	20:38:05	223.0000	4042.344	145.920
2013/06/18	21:38:05	224.0000	4041.086	145.949
2013/06/18	22:38:05	225.0000	4039.759	145.965
2013/06/18	23:38:05	226.0000	4038.466	145.983
2013/06/19	00:38:05	227.0000	4037.223	146.001
2013/06/19	01:38:05	228.0000	4036.000	146.026
2013/06/19	02:38:05	229.0000	4034.786	146.050
2013/06/19	03:38:05	230.0000	4033.580	146.070
2013/06/19	04:38:05	231.0000	4032.409	146.088
2013/06/19	05:38:05	232.0000	4031.230	146.107
2013/06/19	06:38:05	233.0000	4030.054	146.120
2013/06/19	07:38:05	234.0000	4028.930	146.147
2013/06/19	08:38:05	235.0000	4027.797	146.172
2013/06/19	09:38:05	236.0000	4026.692	146.188
2013/06/19	10:38:05	237.0000	4025.546	146.205
2013/06/19	11:38:05	238.0000	4024.458	146.230
2013/06/19	12:38:05	239.0000	4023.340	146.237
2013/06/19	13:38:05	240.0000	4022.299	146.264
2013/06/19	14:38:05	241.0000	4021.197	146.277
2013/06/19	15:38:05	242.0000	4020.134	146.295
2013/06/19	16:38:05	243.0000	4019.087	146.318
2013/06/19	17:38:05	244.0000	4018.021	146.336
2013/06/19	18:38:05	245.0000	4016.974	146.352
2013/06/19	19:38:05	246.0000	4015.938	146.363
2013/06/19	20:38:05	247.0000	4014.916	146.388
2013/06/19	21:38:05	248.0000	4013.878	146.392
2013/06/19	22:38:05	249.0000	4012.933	146.419
2013/06/19	23:38:05	250.0000	4011.924	146.437
2013/06/20	00:38:05	251.0000	4010.938	146.451
2013/06/20	01:38:05	252.0000	4009.936	146.466
2013/06/20	02:38:05	253.0000	4008.972	146.480
2013/06/20	03:38:05	254.0000	4007.958	146.493
2013/06/20	04:38:05	255.0000	4007.060	146.516
2013/06/20	05:38:05	256.0000	4006.097	146.521
2013/06/20	06:38:05	257.0000	4005.167	146.536
2013/06/20	07:38:05	258.0000	4004.219	146.554
2013/06/20	08:38:05	259.0000	4003.320	146.570
2013/06/20	09:38:05	260.0000	4002.343	146.577
2013/06/20	10:38:05	261.0000	4001.457	146.592
2013/06/20	11:38:05	262.0000	4000.550	146.613
2013/06/20	12:38:05	263.0000	3999.625	146.622
2013/06/20	13:38:05	264.0000	3998.730	146.633
2013/06/20	14:38:05	265.0000	3997.902	146.658
2013/06/20	15:38:05	266.0000	3996.969	146.665
2013/06/20	16:38:05	267.0000	3996.073	146.673
2013/06/20	17:38:05	268.0000	3995.225	146.694
2013/06/20	18:38:05	269.0000	3994.324	146.707

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2013/06/20	19:38:05	270.0000	3993.526	146.719
2013/06/20	20:38:05	271.0000	3992.627	146.728
2013/06/20	21:38:05	272.0000	3991.794	146.741
2013/06/20	22:38:05	273.0000	3990.944	146.752
2013/06/20	23:38:00	273.9986	3990.887	146.761
2013/06/21	00:38:00	274.9986	3990.845	146.757
2013/06/21	01:43:00	276.0819	3990.842	146.759
2013/06/21	02:43:00	277.0819	3990.825	146.757
2013/06/21	03:43:00	278.0819	3990.820	146.763
2013/06/21	04:38:00	278.9986	3990.834	146.763
2013/06/21	05:38:00	279.9986	3990.748	146.752
2013/06/21	06:43:00	281.0819	3990.786	146.761
2013/06/21	07:43:00	282.0819	3990.772	146.761
2013/06/21	08:43:00	283.0819	3990.741	146.761
2013/06/21	09:38:00	283.9986	3990.712	146.761
2013/06/21	10:38:00	284.9986	3990.746	146.766
2013/06/21	11:38:00	285.9986	3990.703	146.759
2013/06/21	12:43:00	287.0819	3990.688	146.763
2013/06/21	13:38:00	287.9986	3990.689	146.764
2013/06/21	14:38:05	289.0000	3986.954	146.820
2013/06/21	15:38:05	290.0000	3982.982	146.878
2013/06/21	16:38:05	291.0000	3979.093	146.926
2013/06/21	17:38:05	292.0000	3975.451	146.988
2013/06/21	18:38:05	293.0000	3971.866	147.027
2013/06/21	19:38:05	294.0000	3968.400	147.081
2013/06/21	20:38:05	295.0000	3965.107	147.128
2013/06/21	21:38:05	296.0000	3961.863	147.173
2013/06/21	22:38:05	297.0000	3958.714	147.216
2013/06/21	23:38:05	298.0000	3955.670	147.256
2013/06/22	00:38:05	299.0000	3952.713	147.297
2013/06/22	01:38:05	300.0000	3949.775	147.331
2013/06/22	02:38:05	301.0000	3946.928	147.360
2013/06/22	03:38:05	302.0000	3944.199	147.402
2013/06/22	04:38:05	303.0000	3941.508	147.432
2013/06/22	05:38:05	304.0000	3938.906	147.465
2013/06/22	06:38:05	305.0000	3936.384	147.495
2013/06/22	07:38:05	306.0000	3902.823	147.834
2013/06/22	08:38:05	307.0000	3861.414	148.203
2013/06/22	09:38:05	308.0000	3834.122	148.402



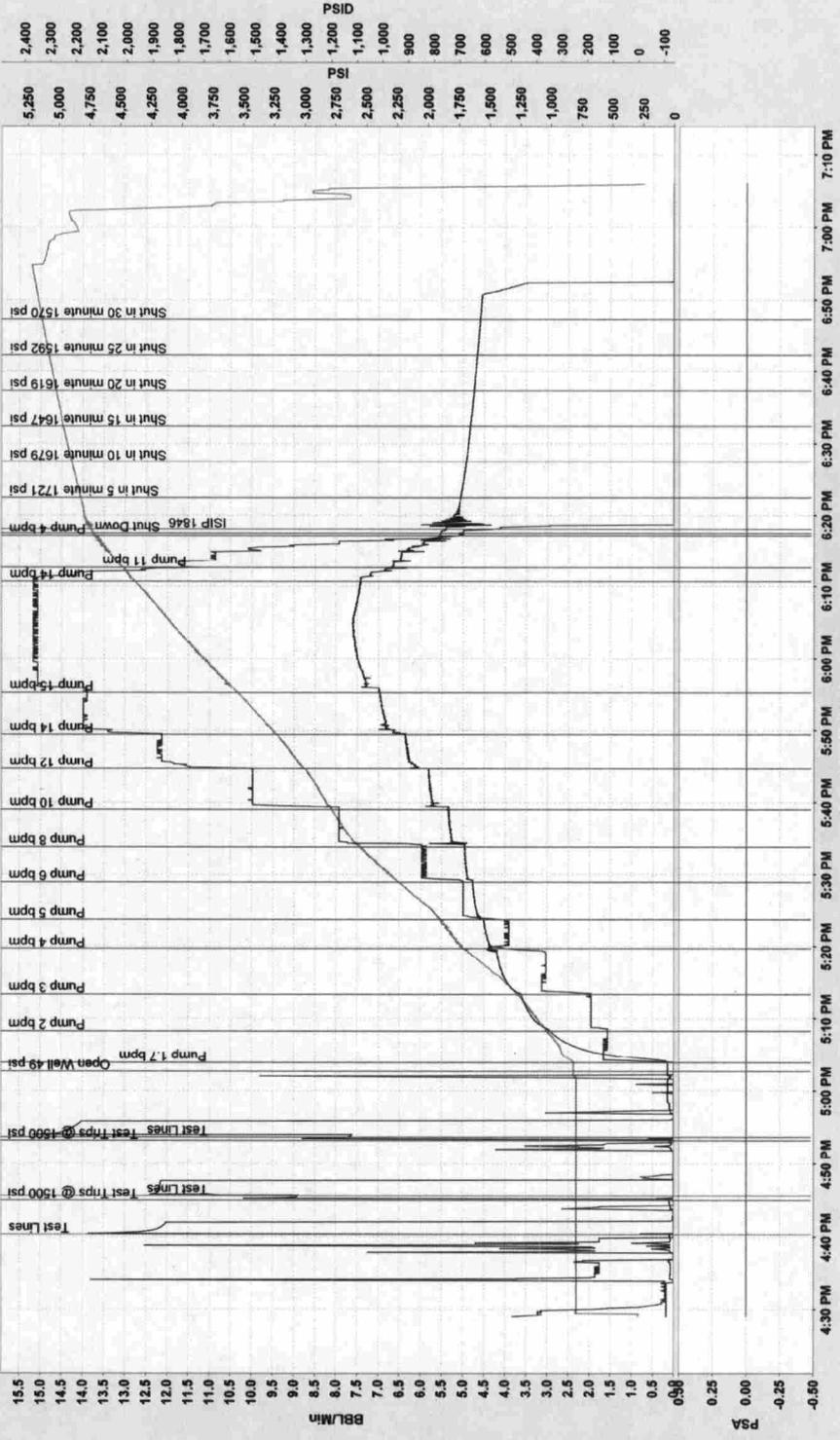






Northstar Khaili #3 SWD

- Well Head PSA
- Well Head Slurry Flow
- Well Head Pressure
- Differential Pressure
- Analog #7 Value
- Flow
- Pressure



Time [ Jun 10, 2013 ]

6/10/13 4:29 PM - 6/10/13 7:05 PM

4:00 PM 4:30 PM 5:00 PM 5:30 PM 6:00 PM 6:30 PM 7:00 PM 7:10 PM

[1] New Stage First - Total(s)

Time	Comment	SLURRYjob (2)	
19:00:00			
09:24:31		142	0

[1] New Stage First - Job Log

Time	Comment	CASING-psi	SLURRY	SLURRYstg	SLURRYjob (2)	
09:24:30	End Job	-2500	0.1	143	142	

[1] New Stage First - Job Log - continued

Time	Comment					
09:24:30	End Job		0			

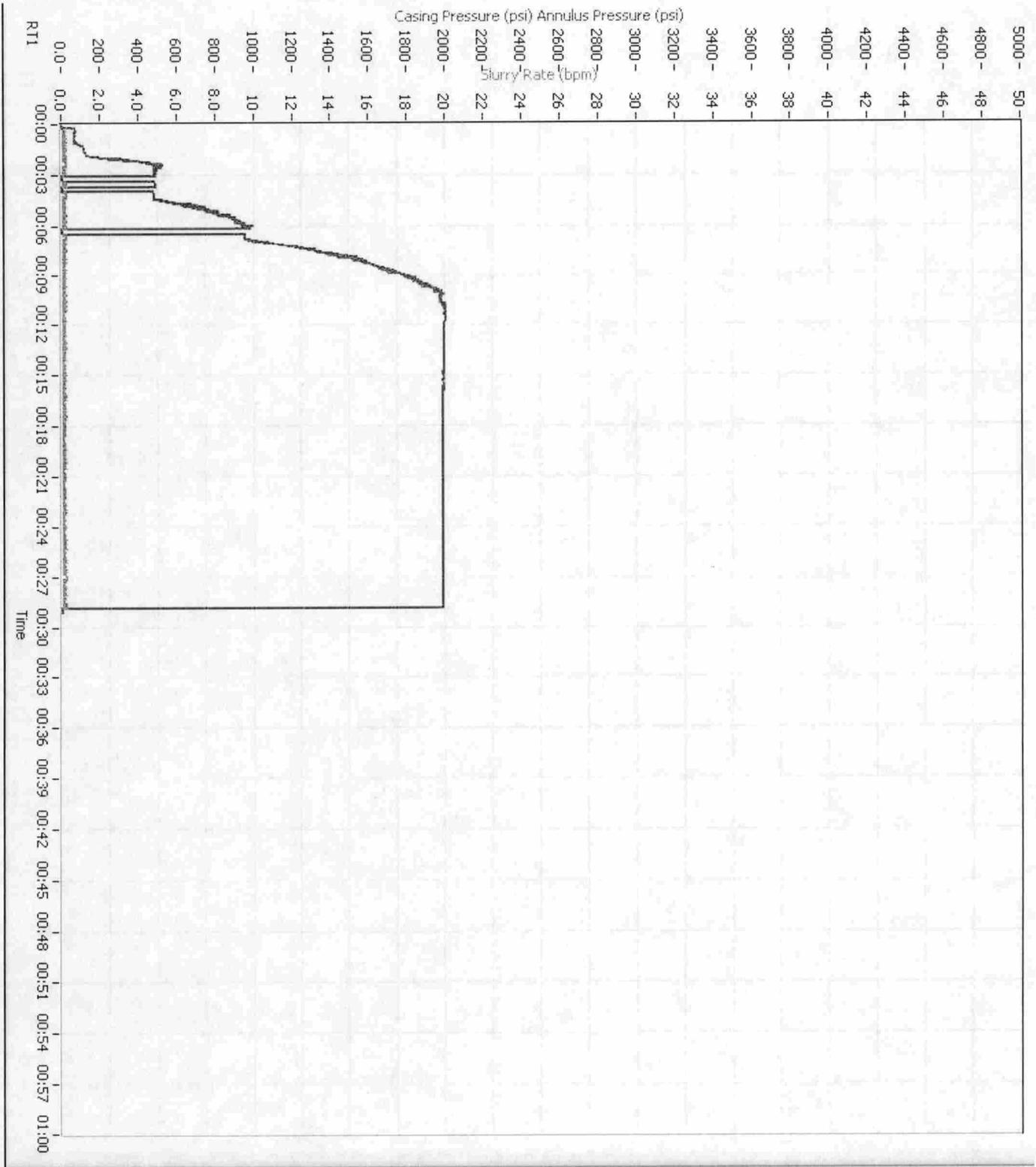


[1] New Stage First - Key & Unit(s)

Name	Abbreviation	Units
Casing Pressure	CASING-psi	psi
Sine		
Slurry Rate	SLURRY	bpm
Slurry Fluid Volume Stage	SLURRYstg	gal
Slurry Fluid Volume Job	SLURRYjob (2)	gal
Clean Fluid Rate	CLEANf (2)	bpm
Horsepower - Total	HHPtot (2)	hhp
Annulus Pressure	ANNp (2)	psi
Sine		



[1] New Stage First - Recorded Time Plot 1 - 1 of 1



[1] New Stage First - Recorded Time Plot 1 - 1 of 1



[2] New Stage - Average(s)

Time		Comment	CASING-psi	SLURRY
10:17:25	Start Avg			
11:22:22	Stop Avg	Establish Rate	1702	6.4

[2] New Stage - ISIP(s)

Time		Comment	CASING-psi
11:22:06	Start ISIP		
11:24:42	Stop ISIP	Check Rs & Ps	0
Time		Comment	CASING-psi
11:24:45	Start ISIP		
11:24:50	Stop ISIP	Check Rs & Ps	0
Time		Comment	CASING-psi
11:25:12	Start ISIP		
11:34:46	Stop ISIP	ISIP 3 min	0

[2] New Stage - Total(s)

Time	Comment	SLURRYjob (2)	
19:00:00			
11:34:46		17982	0



[2] New Stage - Job Log

Time	Comment	CASING-psi	SLURRY	SLURRYstg	SLURRYjob (2)	CASING-psi
10:14:54	Test Lines	2314	0.1	79	79	2314
10:17:22	Establish Rate	215	2.6	469	470	215
10:19:25	Check Rs & Ps	986	2.8	718	717	986
10:20:23	Establish Rate	1177	4.9	875	874	1177
10:21:25	Check Rs & Ps	1289	5.0	1092	1091	1289
10:23:25	Check Rs & Ps	1401	4.9	1506	1506	1401
10:25:25	Check Rs & Ps	1494	4.9	1920	1920	1494
10:27:25	Check Rs & Ps	1567	4.9	2336	2337	1567
10:29:25	Check Rs & Ps	1626	4.8	2751	2751	1626
10:31:25	Check Rs & Ps	1699	4.9	3168	3168	1699
10:32:32	Establish Rate	1753	5.4	3408	3408	1753
10:33:25	Check Rs & Ps	1782	5.6	3610	3610	1782
10:35:25	Check Rs & Ps	1846	5.4	4068	4067	1846
10:37:25	Check Rs & Ps	1895	5.5	4524	4523	1895
10:38:30	Establish Rate	1938	5.4	4772	4771	1938
10:39:25	Check Rs & Ps	1943	5.5	4981	4981	1943
10:41:25	Check Rs & Ps	1943	5.0	5414	5414	1943
10:43:25	Check Rs & Ps	1938	5.0	5833	5830	1938
10:45:25	Check Rs & Ps	1904	4.8	6250	6246	1904
10:47:25	Check Rs & Ps	1870	4.9	6667	6663	1870
10:49:25	Check Rs & Ps	1836	4.9	7082	7077	1836
10:51:25	Check Rs & Ps	1772	5.0	7496	7493	1772
10:52:46	Establish Rate	1782	5.5	7784	7781	1782
10:53:25	Check Rs & Ps	1763	5.5	7933	7930	1763
10:55:15	Establish Rate	1714	6.0	8358	8355	1714
10:55:25	Check Rs & Ps	1763	6.0	8406	8403	1763
10:57:26	Check Rs & Ps	1714	6.5	8917	8916	1714
10:59:00	Establish Rate	1738	6.9	9356	9356	1738
10:59:26	Check Rs & Ps	1680	7.1	9482	9481	1680
11:01:22	Establish Rate	1680	7.6	10062	10061	1680
11:01:26	Check Rs & Ps	1660	7.5	10081	10080	1660
11:02:36	Establish Rate	1670	8.0	10460	10457	1670
11:03:26	Check Rs & Ps	1699	8.0	10738	10734	1699
11:05:26	Check Rs & Ps	1709	8.0	11415	11412	1709
11:06:50	Establish Rate	1719	8.6	11897	11893	1719
11:07:26	Check Rs & Ps	1709	8.7	12113	12110	1709
11:09:26	Check Rs & Ps	1709	8.6	12844	12841	1709
11:11:26	Establish Rate	1807	9.4	13605	13598	1807
11:11:26	Check Rs & Ps	1807	9.4	13608	13598	1807
11:13:26	Check Rs & Ps	1772	9.4	14390	14389	1772
11:15:26	Check Rs & Ps	1826	9.8	15203	15201	1826
11:17:26	Check Rs & Ps	1826	9.9	16035	16034	1826
11:19:26	Check Rs & Ps	1802	9.9	16859	16862	1802
11:21:27	Check Rs & Ps	1816	10.0	17692	17696	1816
11:22:18	Shut Down	1553	0.1	17966	17969	1553
11:23:27	Check Rs & Ps	1445	0.1	17971	17974	1445
11:24:54	ISIP 3 min	1377	0.1	17977	17980	1377
11:27:44	ISIP 5 min	1357	-47.6	17979	17982	1357
11:34:44	End Job	-15	-47.6	17979	17982	-15

[2] New Stage - Job Log - continued



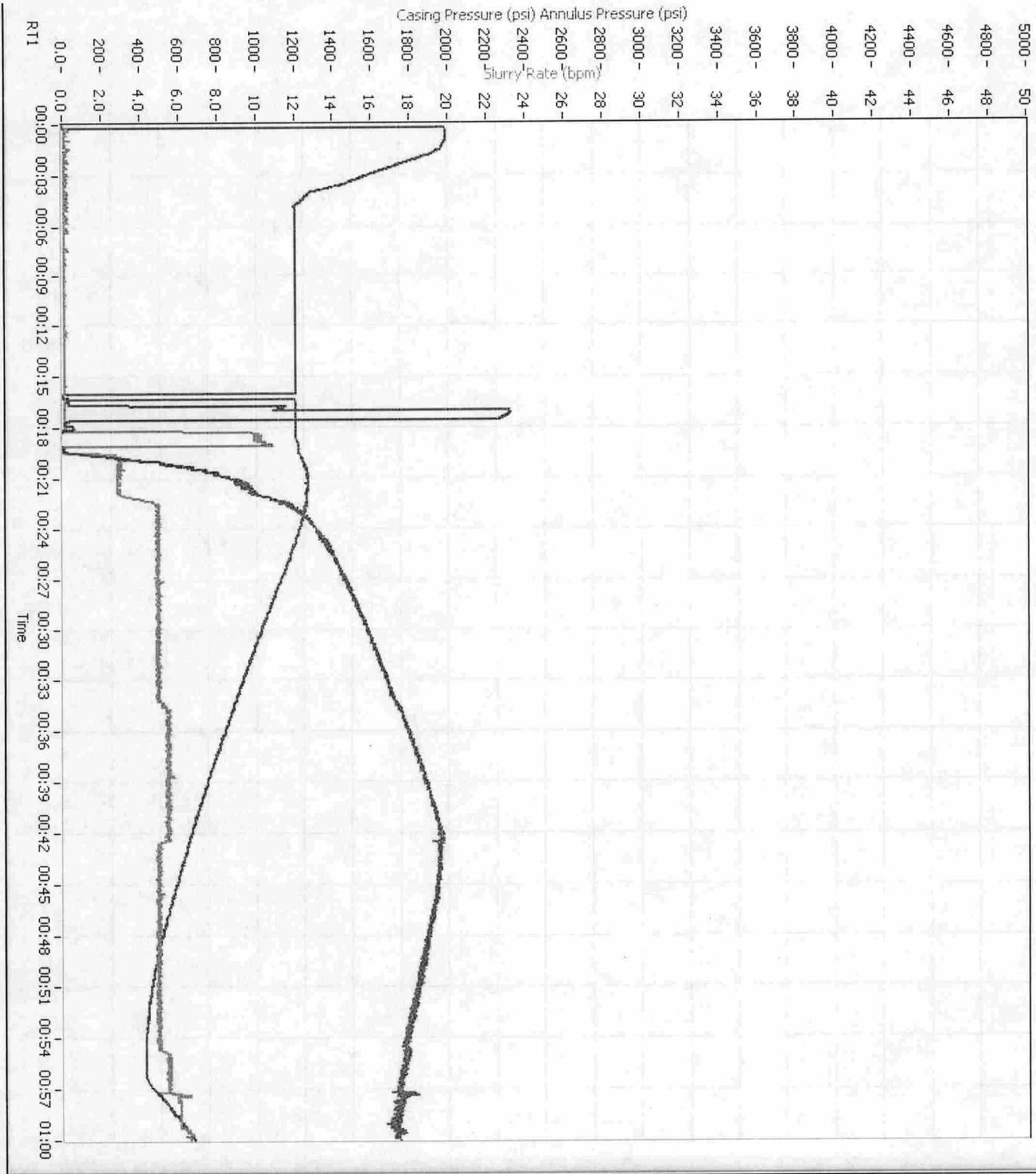
Time	Comment	CASING-psi	CASING-psi	ANNp (2)	HHPtot (2)
10:14:54	Test Lines	2314	2314	1206	5
10:17:22	Establish Rate	215	215	1235	12
10:19:25	Check Rs & Ps	986	986	1260	67
10:20:23	Establish Rate	1177	1177	1255	139
10:21:25	Check Rs & Ps	1289	1289	1230	160
10:23:25	Check Rs & Ps	1401	1401	1167	173
10:25:25	Check Rs & Ps	1494	1494	1104	181
10:27:25	Check Rs & Ps	1567	1567	1035	186
10:29:25	Check Rs & Ps	1626	1626	967	194
10:31:25	Check Rs & Ps	1699	1699	903	210
10:32:32	Establish Rate	1753	1753	874	232
10:33:25	Check Rs & Ps	1782	1782	845	244
10:35:25	Check Rs & Ps	1846	1846	781	249
10:37:25	Check Rs & Ps	1895	1895	723	252
10:38:30	Establish Rate	1938	1938	693	255
10:39:25	Check Rs & Ps	1943	1943	669	263
10:41:25	Check Rs & Ps	1943	1943	620	237
10:43:25	Check Rs & Ps	1938	1938	566	239
10:45:25	Check Rs & Ps	1904	1904	518	226
10:47:25	Check Rs & Ps	1870	1870	479	226
10:49:25	Check Rs & Ps	1836	1836	444	220
10:51:25	Check Rs & Ps	1772	1772	425	218
10:52:46	Establish Rate	1782	1782	420	241
10:53:25	Check Rs & Ps	1763	1763	420	237
10:55:15	Establish Rate	1714	1714	508	257
10:55:25	Check Rs & Ps	1763	1763	522	263
10:57:26	Check Rs & Ps	1714	1714	664	273
10:59:00	Establish Rate	1738	1738	767	293
10:59:26	Check Rs & Ps	1680	1680	791	294
11:01:22	Establish Rate	1680	1680	898	305
11:01:26	Check Rs & Ps	1660	1660	903	315
11:02:36	Establish Rate	1670	1670	962	319
11:03:26	Check Rs & Ps	1699	1699	996	333
11:05:26	Check Rs & Ps	1709	1709	1074	335
11:06:50	Establish Rate	1719	1719	1118	364
11:07:26	Check Rs & Ps	1709	1709	1133	367
11:09:26	Check Rs & Ps	1709	1709	1191	367
11:11:26	Establish Rate	1807	1807	1250	416
11:11:26	Check Rs & Ps	1807	1807	1250	416
11:13:26	Check Rs & Ps	1772	1772	1274	408
11:15:26	Check Rs & Ps	1826	1826	1294	437
11:17:26	Check Rs & Ps	1826	1826	1323	441
11:19:26	Check Rs & Ps	1802	1802	1353	431
11:21:27	Check Rs & Ps	1816	1816	1377	443
11:22:18	Shut Down	1553	1553	1382	4
11:23:27	Check Rs & Ps	1445	1445	1426	3
11:24:54	ISIP 3 min	1377	1377	1489	3
11:27:44	ISIP 5 min	1357	1357	1582	0
11:34:44	End Job	-15	-15	557	17



[2] New Stage - Key & Unit(s)

Name	Abbreviation	Units
Casing Pressure	CASING-psi	psi
Sine		
Slurry Rate	SLURRY	bpm
Slurry Fluid Volume Stage	SLURRYstg	gal
Slurry Fluid Volume Job	SLURRYjob (2)	gal
Clean Fluid Rate	CLEANf (2)	bpm
Horsepower - Total	HHPtot (2)	hhp
Annulus Pressure	ANNp (2)	psi
Sine		

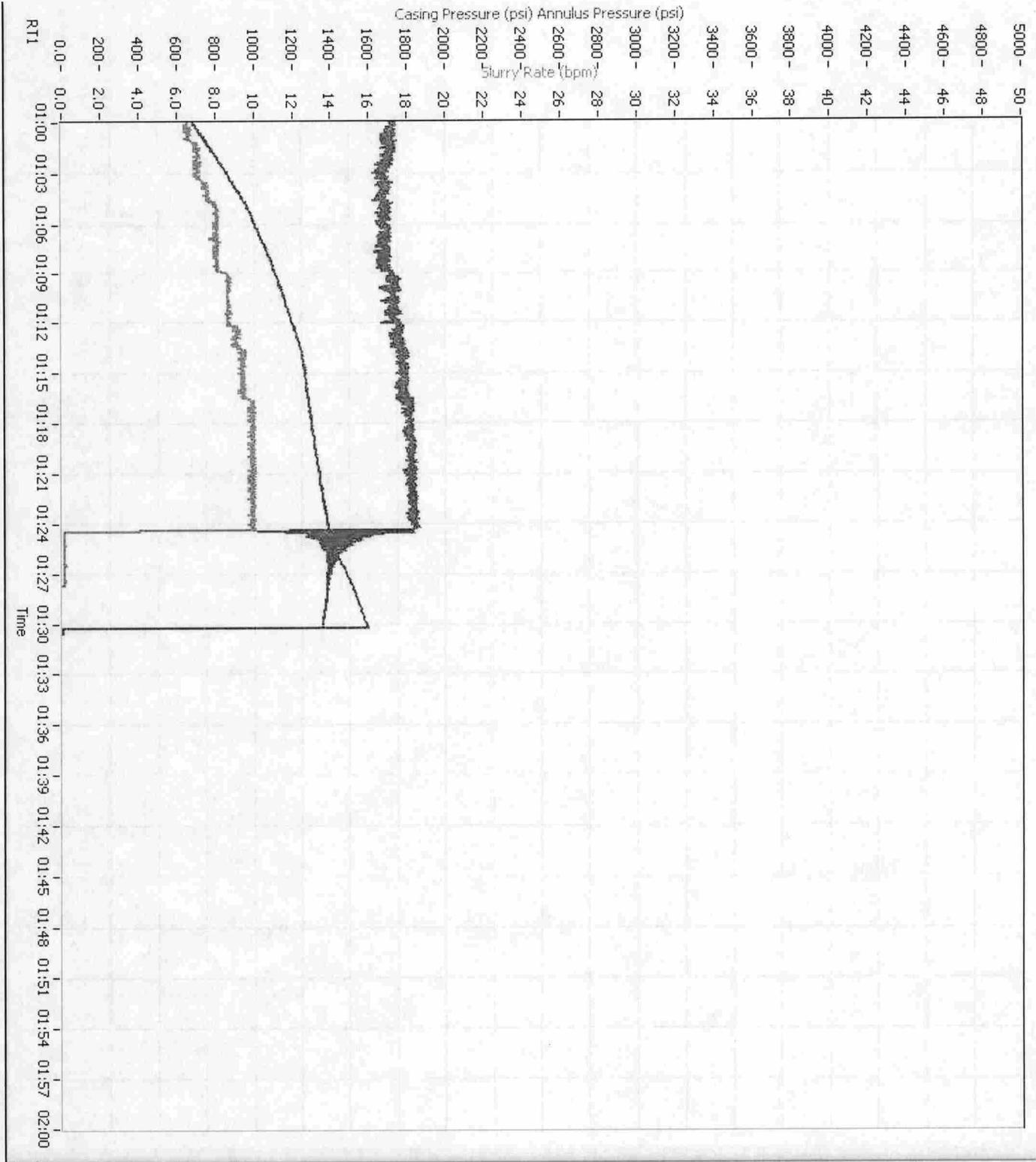
[2] New Stage - Recorded Time Plot 1 - 1 of 2



[2] New Stage - Recorded Time Plot 1 - 1 of 2



[2] New Stage - Recorded Time Plot 1 - 2 of 2

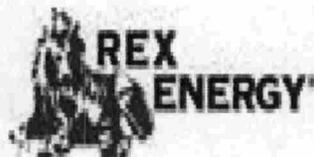


[2] New Stage - Recorded Time Plot 1 - 2 of 2



**Radiation Action, Monitoring, and  
Disposal Plan**

R.E. Gas Development, LLC  
R.E. Disposal # 1  
1933 Old McCartney Road  
Campbell, Ohio 44405



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# Introduction

The following describes the Radiation Monitoring, Action Plan, and Disposal (Plan) for the R. E. Gas Development, LLC (Rex) Injection well in the City of Campbell, Mahoning County, Ohio. This Plan contains procedures for monitoring for and responding to radioactive materials detected entering the facility and describes related procedures for personnel training, Ohio Department of Health notification and ODNR, recordkeeping, and reporting.

The facility will receive oil and gas liquid waste known as Brine for deep well injection into a Class II well. The purpose of this Policy is to establish work practices that will ensure proper handling and disposal of Naturally Occurring Radioactive Material (NORM) and Technologically Enhanced Radioactive Material (TENORM).

This Plan includes the following sections:

- Section 1 - Radiation Monitoring
- Section 2 - Action Levels and Response
- Section 3 - Plan Implementation
- Section 4 - Designated Isolation Area
- Section 5 - Characterization Procedures
- Section 6 - Disposal Plan
- Section 7 - Personnel Training
- Section 8 - Recordkeeping

Each section of the Plan includes specific requirements and/or procedures to be followed to meet the requirements of the regulations.

## Section 1

# Radiation Monitoring

### 1.1 Introduction

The treatment facility is designed to accept produced waters from natural gas and oil wells. Representative samples of water will be collected and analyzed for radionuclide composition and characterization at the well field prior to the initial shipment to the facility, annually, and after a significant operation change in production. The water samples will be analyzed for radionuclide composition by isotopic analysis, specifically Ra-226 and Ra-228, naturally occurring isotopes of uranium and thorium, and the presence of any gamma emitting radionuclides other than those naturally occurring radionuclides. In addition, slurries and solids produced during, and as a result of, the processing of residual wastes at the facility will be surveyed for ionizing radiation in the vicinity of the process equipment and the solids storage locations. The results of all radiological analyses and surveys will be recorded and available for inspection by ODNR and OEPA. and, as discussed below, performed and documented in accordance with state approved protocols and equipment and by properly trained and supervised personnel.

### 1.2 Scoping Analysis

a scoping analysis of a range of radionuclide compositions of residual waste that may be delivered to the facility and the exposure rates in the vicinity of the solids production and storage locations. the concentrations of Ra-226 and Ra-228 observed in residual waste samples from different well fields varied by over two orders of magnitude. It is anticipated that, when brine waters at this facility are processed and/or store; solids in the form of sludge will be produced that may contain varying concentrations of naturally occurring radionuclides. This in turn will result in external radiation exposure rates that may also be highly variable.

These exposure rates drop off quickly with distance from the side of a roll-off container; i.e., the dose rate drops down by about a factor of 10 at 10 feet from the roll-off and by about a factor of 1000 at 100 feet from the roll-off. The implications of these calculations are that (1) radiation surveys performed in the vicinity of the tanks containing produced water shipped to the facility are unlikely to detect any elevation in the natural background radiation exposure rate, (2) it is highly unlikely that anyone at the site will experience an annual dose approaching 100 mrem, and (3) some of the solids shipped for disposal will need to be defined as TENORM and managed in accordance with state regulations and guidelines applicable to TENORM. These matters are addressed in subsequent sections

### 1.3 Portable Radiation Monitoring Equipment

Properly trained personnel, who meet the requirements of the Plan, will utilize a hand-held survey meter that meets the requirements of the Bureau of Radiation Protection. This instrument will be used to measure and record exposure rates (radiation levels) in the vicinity of process equipment and waste staging areas where the highest levels of radiation exposure are anticipated and where workers are anticipated to be located for extended periods of time. The surveys will be used to ensure and document that exposures to workers are as far below the radiation protection standards for members of the general public as is reasonable achievable. The survey meter will be recalibrated on an annual basis to a Cesium (Cs)-137 U.S. National Institute of Standards and Technology (NIST)-traceable source.

Our plan is to perform a walkover survey of the site in order to establish a baseline that defines the natural background radiation contours at the site. We anticipate some variability in the natural background due to variations in the soil composition across the site and also due to the presence of surface features at different locations across the site. For example, a preliminary walkover survey using a hand-held 1 inch sodium iodide (NaI) survey meter at another similar site revealed external exposure rates that varied from about 7 to 10  $\mu\text{R/hr}$ . We expect a similar range of background radiation exposures at the subject facility; however, we expect small differences between the sites due to differences in soil composition. We also expect that the radiation field at a given location at the site will vary from time to time due to changes in the moisture content of the soil and certainly due to snow cover. Our plan is to perform an annual walkover survey of un-impacted areas for use as a baseline against which to assess and document the radiation fields in the vicinity of impacted and potentially impacted areas at the site.

We plan to perform and document monthly radiation surveys in the vicinity of equipment and sludge storage locations (i.e., areas where we can expect some increase in the background radiation levels due to the presence of TENORM).

Full time workers, who have the greatest potential to experience elevated exposures associated with TENORM on site, will be issued either thermoluminescent dosimeters (TLDs) or optically stimulated luminescent (OSL) dosimeters, which will be changed out quarterly. The initial baseline walkover survey, the routine surveys of the water treatment and solids storage areas, and the personal dosimetry monitoring program will be used in combination to monitor and record the radiation exposures experienced by personnel at the site, with the objective of ensuring that no worker experiences exposures that approach 100 mrem/yr and to provide the information needed to ensure that exposures are maintained as low as is reasonably achievable.

Properly trained personnel will also have access to a hand-held multi-channel analyzer (MCA) that can be used to identify the isotopes that are responsible for any observed elevated levels of external exposure. However, it should be recognized that, since the radionuclide composition of water delivered to the site will be fully characterized; the sources of elevated exposure rates can be readily surmised and anticipated to be due to elevated levels of Ra-226 in the incoming brine. Nevertheless, the use of the MCA will provide further assurance that the site will be able to detect and identify any unknown source of gamma emitters. The MCA will have the ability to download any gamma spectrum found during surveying to a computer. This instrument will have a built-in low-level radioactive source that will allow self-calibration whenever the MCA is turned on. The MCA will be pre-calibrated for the dose rate function on an annual basis to a Cs-137 NIST-traceable source.

The portable radiation monitoring equipment will contain detectors and readout displays meeting the following criteria:

1. The portable monitoring equipment will have a range of gamma dose rate measurements (i.e. 10  $\mu\text{R hr}$  to over 50 mrem hr).
2. The monitoring equipment will be capable of detecting and displaying ambient background radiation levels. The monitoring system will be equipped with a visual readout of the radiation level in  $\mu\text{Sv hr}$ ,  $\mu\text{rem hr}$ ,  $\mu\text{R hr}$ , or counts per minute (cpm).
3. The readout on the instrumentation will provide scale multiplying factors or logarithmic scales to display higher radiation levels.
4. Portable instrumentation will be powered either by replaceable batteries or power cells with charging units and provide indication if battery/power cell capacity is not at levels for proper unit function.
5. The range of readout for portable (hand-held) monitoring equipment will be 0.01 to approximately 100 mrem hr and have a known gamma energy response.
6. Portable instruments shall be calibrated to a Cs-137 NIST-traceable source as required by the instrument manufacturer, but at least once a year. Hand-held equipment will be sent to a facility identified by either the instrument manufacturer or consulting Health Physicist. Rex will make arrangements with this calibration facility for back-up instruments to be provided so that normal operations can continue.
7. Radiation monitors may be response checked daily on a relative basis.

## 1.4 Evaluation Equipment

If a radiation alarm is determined to be valid, additional supplies may be required to determine the specific radioisotope. The following equipment and supplies will be available on-site as necessary for handling of such radioactive material samples:

1. Portable MCA coupled to a NaI detector or solid state detector. Appropriate calibration source(s) will also be needed to check the library of spectra.
2. Probes for survey meter capable of detecting beta and gamma radiation. Depending on the survey meter and probe(s) used for beta/gamma monitoring, a different probe could be obtained for alpha monitoring, if desired.
3. Supplies for taking samples for laboratory analysis, such as containers for water samples.
4. Disposable protective clothing and gloves for personnel handling potentially contaminated waste.
5. A supply of radiation warning signs, rope, tape, etc.
6. Supplies and information for data analysis, e.g., scientific calculator, survey forms, tables of radioisotopes with half-life, etc.

## Section 2

# Action Levels and Response

The procedures described in Section 3 of this Plan must be implemented if the presence of radioactive material is indicated by the radiation monitoring device. The following describes the action levels requiring a response.

ActionLevelOne: Action Level One occurs when the radiation monitoring instrument registers a reading of 10  $\mu\text{R hr}$  above background.

(Note: The regulations require a gamma exposure rate from a cesium 137 source, at a level no higher than 10  $\mu\text{R hr}$  above the average local background, at any detector element, shall cause an alarm at the facility. Instrument background shall be kept below 10  $\mu\text{R hr}$  using shielding if needed, and the system shall be set to detect gamma ray energies of 50 kilo electron volts and higher.)

ActionLevelTwo: Radiation dose rates of 20  $\mu\text{Sv hr}$  (2 mrem hr) or greater in the cab of the waste transport vehicle, 500  $\text{pSv hr}$  (50 mrem hr) or greater from any other surface, or the detection of contamination on the outside of the vehicle. The contamination limits for removable beta/gamma radiation are set by 10 CFR 49, Section 173.443 at 6,600 dpm/300  $\text{cm}^2$  (2,200 dpm/100  $\text{cm}^2$ ). Action Level Two requires immediate notification of the Department and isolation of the vehicle.

## 2.1 Detection and Initial Response

The standard format and content guidance for the Plan is especially concerned with material delivered to a landfill or transfer facility that contains unexpected elevated levels of radioactive material. As described above, such circumstances cannot occur at the subject facility. Nevertheless, this Plan includes provisions for dealing with unexpected circumstances.

Through the use of shielding calculations using MicroShield, we have determined that the radiation field in the immediate vicinity of a cylindrical tank, 12 feet high and 6 foot radius, containing about 15,000 pCi/L of Ra-226, in full equilibrium with its progeny, will result in a radiation field of approximately 10  $\mu\text{R/hr}$  above natural background. Hence, before the first shipment of water from a well field is transported to the facility, it will be characterized in a manner that there will be no surprises with respect to the radiation fields that will be associated with the treatment of the water. Appendix A provides important baseline information characterizing the relationship between the concentration of Ra-226 in the water and the radiation field in the vicinity of the solids resulting from water treatment assuming all progeny in equilibrium. These calculated values are likely overestimated by at least 12% to 15% because the derived concentrations do not take into consideration the concrete that will be added to the sludge as a stabilizing agent, nor do the values account for shielding afforded by the container walls, which would result in a modest reduction in the derived radiation fields. The variability in the relationships in Appendix A is primarily due to the variability in the dissolved solids in the water in different wells for wells with relatively high Ra-226 concentrations (i.e. thousands of pCi/L). However, for water samples with relatively low Ra-226 concentrations (i.e., hundreds of pCi/L), the concentrations of Ra-228 are in many cases comparable to that of Ra-226, and the ratio is substantially higher. As a rule of thumb, for the water with the higher Ra-226 concentrations, the relationship appears to be less than 0.01  $\mu\text{R/hr}$  at contact with a roll-off containing solids per pCi/L of Ra-226 in the water that was treated and that

produced the solids. As stated previously, it is assumed that all progeny of Ra-226 and Ra-228 are in full equilibrium for all cases.

Care will be taken in making use of these relationships because we recognize that radon and its progeny in produced water recently extracted from the ground may not be present in equilibrium with Ra-226, and certainly solids freshly produced from the water treatment process will not contain radon and its progeny in equilibrium. Hence, relatively high concentrations of Ra-226 might be present in freshly produced water, but gamma surveys may read at background levels (i.e., 7 to 10  $\mu\text{R/hr}$ ). It is for this reason that it is essential that isotopic analysis of the produced water from each well field be performed and recorded, using radon emanation analytical techniques, at the time that water from each well field is first sent to the facility for treatment. The water treated at the facility on any given day is expected to be closer to the average concentrations provided in Table A-1 because the facility is expected to receive water from several well pads concurrently.

As a rule of thumb, the relationship between Ra-226 in water (in full equilibrium with its progeny) and the radiation field at contact with a 20 cubic yard roll-off containing the solids associated with the treatment of this water is expected to be no more than about 0.01  $\mu\text{R/hr}$  per pCi/L of Ra-226. Hence, at 150,000 pCi/L, the radiation field at contact of a 20 cubic yard roll off containing the solids associated with processing that water is expected to be about 1.5 mrem/hr (note, for the purpose of this Plan, we are treating a Roentgen as equivalent to a rem). We believe that, through proper design of the facility, training, and operational procedures, if water containing as much as 150,000 pCi/L were to be shipped to the facility, a circumstance that we do not anticipate given the data we have compiled to date, the solids associated with processing that water could be managed without resulting in exposures to workers in excess of 100 mrem/yr effective dose equivalent (EDE).

If the surveys in the vicinity of any systems and equipment indicate radiation fields that could result in radiation exposures to workers in excess the radiation exposure limits for members of the public (e.g., 50  $\mu\text{R/hr}$  above background in heavily occupied locations) or can be reduced to lower levels in accordance with as-low-as-reasonably-achievable (ALARA) principles, action will be taken to reduce the exposure. These actions could include limiting access to the area (including posting signs) and relocating the equipment to an access controlled area.

Staged slurries and solids that exceed Action Level One will be recorded and labeled in order to ensure that their shipment offsite and disposal are performed in accordance with DOT and Ohio requirements. Section 7 of this Plan presents additional discussion and analysis of the disposition of the solids associated with the operations and decommissioning of this facility. Consideration has also been given to the potential for inhalation exposure to radium and radon progeny. The sludge produced from processing produced water will remain as a moist sludge at all times. As a result, there is no potential for fugitive dust.

## 2.2 Action Level One Procedures

1. If the radiation level on a second measurement registers radiation greater than the specified rates in Action Level One, move the vehicle to the Designated Isolation Area and notify the local Health & Safety/Environmental Manager.
2. Personnel shall verify that the dose rates are less than 0.05 mR hr outside the site boundary.
3. If treatment or processing is considered, keep the load onsite until the nature of the RAM and proper actions are determined.
4. If the driver leaves with the vehicle without a DOT Exemption Form and before the RAM can be evaluated, contact the Ohio State Highway Patrol and provide them with any information you may have on the vehicle such as make, model, color, company name, license plate number, time left and the direction in which the vehicle was traveling and, if possible, the intended destination. This is to ensure that the driver does not dispose of the contaminated water improperly.
5. Complete a RAM alarm incident report and record the occurrence in the daily operational log.

## 2.3 Action Level Two Procedures

If the radiation level on a second measurement registers radiation greater than the specified rates in Action Level Two, the following procedures are required:

1. Direct the vehicle to the Designated Isolation Area, remove the driver and keep the driver and all other personnel at least 50 feet from the vehicle.
2. Physically secure the contaminated load against removal or inadvertent disposal (i.e. leaks).
3. All incidents of detection of prohibited Action Level Two radioactive material shall be immediately reported to the Department of Health. Proceed as directed by the AHP.
4. Notify the local Health & Safety/Environmental Manager.
5. Verify that the dose rates are less than 0.05 mR hr outside the boundary of the site.
6. Do not allow the vehicle or container to leave the facility without the permission of the State, and the driver being issued a DOT Exemption Form signed by the Department's AHP or their authorized representative.
7. Complete a RAM alarm incident report and record the occurrence in the daily operational log.

## Section 3

# Plan Implementation

This Section of the Plan describes the individuals responsible for implementation of the Plan, the daily routine procedures to be followed, and the actions to be taken if the portable radiation monitoring equipment is engaged.

### 3.1 Persons Responsible For Implementation of the Plan

The primary individual responsible for implementation of the Plan at the facility is the Site Superintendent (SS). The SS is the individual that is responsible for the daily operation of the facility. One of the other on site facility employees will be designated as the Alternate SS. The Alternate SS will assume the position of the SS in the event that the primary SS is unavailable. These individuals each have the authority to implement the Plan. The SS and Alternate SS will be trained in the fundamentals of radiation safety and detection.

The primary responsibilities of the SS are:

- Sampling of incoming produced water loads for radioactive material (RAM);
- Isolation of potentially affected vehicles;
- Response to radiation readings above action limits;
- Survey and characterization of the water load radioactive sources;
- Monitoring operation of radiation detection equipment; and
- Training and supervision of site personnel in the fundamentals of radiation safety and detection;

### 3.2 Persons Radiation Monitoring

The SS at the facility will be responsible for conducting the daily operation of the portable (hand-held) radiation monitors.

This responsibility includes:

1. Inspection of each tank bottom, sludge present, or filter bag, and their containers;
2. Monitoring of the readout of the detection monitoring equipment;
3. Initial response to readings above the action limit;
4. Notification of the SS and/or AHP in the event of a confirmed reading above the action limit; and
5. Operational checks of the monitoring equipment.

The SS and other facility personnel will be trained in the operation of the device and the fundamentals of radiation safety and detection.

### **3.3 Certified Health Physicist Consultant**

A Certified Health Physicist (CHP) consultant may be utilized by the facility to provide support in the event that further RAM characterization is required.

If necessary, the CHP will perform the characterization and determination of the radiation source and assist in determining the appropriate disposition of the radioactive materials.

### **3.4 Facility Personnel**

Written procedures will be provided to on site personnel and posted on site where they can be seen by the personnel performing the waste monitoring. The procedures will be coordinated in advance with facility personnel, including appropriate notification of other applicable state or local agencies and authorities.

All facility personnel will be trained in the basics of radiation safety. Exposure of the facility staff to radiation is highly unlikely as the incoming water will be contained inside tanker trucks. Under routine circumstances, facility personnel are considered members of the general public (less than 100 mrem per year dose limit) and, as such, will not require individual dose monitoring. On an as-needed basis, radiation dose assessments may be performed on specific individuals associated with a potential exposure resulting from a specific event or source. The dose assessments will be performed by a CHP Consultant retained by Rex.

### **3.5 Persons Daily and Annual Equipment Checks**

Portable radiation monitoring detectors shall be response checked routinely.

Portable radiation monitoring devices shall be calibrated annually to a traceable Cs-137 source. This radiation standard shall be traceable to the U.S. National Institute of Standards and Technology.

### **3.6 Revision of the Plan**

This Plan will be reviewed and updated periodically by the Health & Safety/ Environmental Manager. At a minimum, this will occur when any of the following occurs:

1. Applicable Department regulations or policies are revised;
2. The Action Plan fails during an incident;
3. The facility operation changes in a manner that would interfere with implementation of the Plan;
4. The individual responsible for implementing the plan changes;
5. The monitoring equipment used is changed;
6. The designated area for vehicles in which RAM has been detected changes



## Section 4

# Designated Isolation Area

The location of the Designated Isolation area is to be used for radiation and waste characterization surveys, and if needed, to isolate a vehicle or container and prevent personnel radiation exposure levels as low as reasonably achievable (ALARA). This area is reasonably isolated from personnel work areas and can be roped off and monitored to prevent trespass into the area.

If surveys show that either exterior dose rate limit in Action Level Two is exceeded, but there is no removable contamination on the exterior of the vehicle and the dose rate in the cab is below 50 mrem/hr, the vehicle should be promptly moved to the Designated Isolation Area for additional characterization or evaluation by the SS, CHP, or regulatory staff.

## Section 5

# Characterization Procedures

Depending on the composition, water volumes carrying RAM may be rejected from the facility. The following describes the produced water characterization procedures to be followed once a production water sample has been confirmed to contain radioactive material as indicated by the radiation monitoring instrumentation of the facility.

1. Characterization of any samples will be performed under the direct supervision of the SS or the contracted CHP
2. Characterization of any potential sample will be performed by gamma spectroscopy, analytical, or other equivalent methods, to identify the radioisotope present.

### 5.1 Characterization Procedures

Gamma spectroscopy will be used to identify the radioisotope present in any waste samples exceeding the Action Levels. The specific procedure in the characterization phase will be determined by the SS or CHP, depending on the situation and radiation levels. Procedures will also be determined based on situational factors. The factors to be considered include the the nature of the material, radiation levels indicated by the initial survey, highest dose rate, instrumentation, personnel available, weather, and other factors.

In general, for collected material samples exceeding the Action Levels, appropriate characterization procedures should include the following:

1. Measure the radiation levels in the sample once collected. Using appropriate instrumentation and measurement set-up, identify the radioisotope (i.e., via gamma spectroscopy). If the gamma spectroscopy indicates the radiation is from RAM with a half-life of 65 days or less, the Area Health Physicist may authorize the contents to be processed or disposed of immediately in the facility, provided there is minimal risk to workers. Alternately,
2. The area(s) where radioactive material is identified should be roped off or otherwise secured to prevent persons from entering areas where radiation levels exceed 0.02 mSv hr (2 mrem hr), and labeled with appropriate signs. Radiation levels in areas occupied by operational staff should be kept ALARA. The contaminated waste should be physically secured against removal or inadvertent disposal or else be under observation by facility staff at all times.
3. If radioactive material is not detected in the sample, resurvey the exterior of the vessel. Mark any areas where radiation levels exceed background levels. The source of the radiation may be the transport vehicle itself, storage tank bottoms, pipe scale, and filter socks or other filtering media.



## Section 6

# Disposal Plan

### 6.1 Disposal of NORM and TENORM

Once the source is identified and properly analyzed through a certified laboratory it will be sent for proper disposal. Tank bottoms and filter socks will be the main source of disposal. If radium levels are above a combined 7  $\mu\text{Ci/g}$  (radium 226 & radium 228) they will not be suitable for Ohio landfills. Based off of lab readings, the material will then attempted to be shipped into an approved Pennsylvania landfill through a full Form-U process and state approval. If levels are too high for acceptance into Pennsylvania, the material of concern; whether bulk or drum form, will be shipped into a NORM/TENORM permitted landfill.

All shipments of those materials containing NORM must be coordinated by the RSO and managed accordingly. Disposal options may vary depending upon the media, radionuclide, activity and concentration. Appropriate support from a third-party service provider may be considered for these activities.

## Section 7

# Personnel Training

## 7.1 Training

Rex Energy will arrange to have several levels of training (typically 1-2 hours) for designated staff within the company to ensure all workers who may work on or around sites where NORM/TENORM is possible are qualified and can work safely and know what to do should NORM or TENORM are present at their work site.

Training of the individuals responsible for implementing the Plan, including the SS and facility personnel, will be conducted prior to implementation of the Plan, with annual refresher training in the areas of:

1. Fundamentals of radiation safety;
2. Operation of the monitoring instrumentation used by the facility, including daily operation and other response checks;
3. Radiation Work Procedures; and
4. All aspects of the Plan.

### Basic Radiation Awareness

Designated staff will receive a training session on:

- Sources of radiation;
- Safe work through Time-Distance-Shielding;
- Personal protective equipment use and limitations;
- Awareness that NORM may be present, in low concentrations, during work activities;
- Exposure levels as established by state and/or federal regulators; and
- Emergency procedures.

Training intended for drillers, field staff and people in work yards around drill pipes and other materials, or who service this material will include

- Sources of radiation;
- Radiological fundamentals;
- Biological effects;
- ALARA ("as low as (is) reasonably achievable") philosophy;
- Radiological posting and controls;
- Contamination and exposure controls;
- Personal protective equipment use and limitations;
- Personal hygiene considerations & proper PPE
- Roles and responsibilities; and
- Emergency procedures.

### 3.1.2 Assessor Training

Staff who will need to work with radiation survey meters or collect samples will receive additional training (typically 8 hour) on:

- Use of survey meters;
- Problem solving;

- Sample collection;
- Radiation (action) levels that merit further assessment; and
- Interpretation of state and federal criteria.

Particular attention to the safe operation of the meters, daily calibration, annual manufacturer calibration and limitations and precautions in the use and information gathered when using the meters.

### 3.1.3 Radiation Safety Officer (RSO)

Should Rex not have a qualified RSO upon implementation of this policy, Rex may consider retaining the services of a third party (consultant) to act as RSO or as an interim RSO during a transition period until an internal person can be so appointed/trained.

Duties of the RSO will include:

- Training of all designated workers
- Periodically compile and retain data (per NRC);
- Dosimeter screening on designated staff annually;
- Ensure appropriate assessment (refer to section 3.3) of equipment and materials prior to shipment to a scrap metal or disposal facility;
- Incident response and coordination.
- Proper PPE at all times

## Section 8

# Recordkeeping

### 8.1 Processing of NORM and TENORM

All detections of radioactive material by the radiation monitoring system in excess of Action Levels will be recorded in the daily operational log. The daily operational log will document each alarm of the radiation monitoring system and record the information set listed below for each incident.

All wastes arriving at the facility will be accompanied by documentation that the wastes originated from a well pad where representative samples of water were collected and analyzed for Ra- 226, Ra- 228, isotopes of naturally occurring uranium and thorium and a broad spectrum of gamma emitting radionuclides (i.e., gamma spectrometry)..

The daily operational record will include the following information:

- Date, time, and location of the occurrence;
- A brief narrative description of the occurrence;
- Specific information on the origin of the material, if known;
- A description of the RAM involved, if known;
- The name, address, and telephone number(s) of the supplier, handler, or transporter of the RAM contaminated water, the name of the driver; and
- The final disposition of the material (processed, disposed, or rejected).

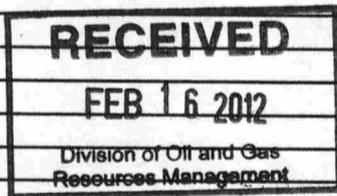
**WELL COMPLETION RECORD (Form 8)**

Ohio Department of Natural Resources  
 Division of Oil and Gas Resources Management  
 2045 Morse Road, Bldg. H-3, Columbus, OH 43229-6693  
 Telephone: 614-265-6633 Fax: 614-265-7998

This report is due in duplicate 60 days after completion of the well. If the permit has expired and the well was not drilled, check the box below, sign on reverse side (Back), and return to our office within 30 days after expiration.

1. Owner #: 2651		3. API #: 34-099-23157-0000	
2. Owner name, address and telephone numbers:  B&L Energy 2761 Salt Springs Rd. Youngstown, OH 44509		4. Type of Permit: NEW WELL, SALT WATER INJECTION	
		5. County: MAHONING	
		6. Civil Township: COITSVILLE	
		7. Footage:  10769 FL 1012 WL	
8. Type of Well: Salt Water Disposal			
9. X: 41.08983308 Y: -80.6126089		21. Date drilling commenced: 8/28/2011	
10. Quad: CAMPBELL		22. Date drilling completed: 10/20/2011	
11. Section: 12. Lot:		23. Date put into production:	
13. Fraction: 14. Qtr.Twp:		24. Date plugged if dry:	
15. Tract:		25. Producing formation: NA	
16. Allot:		26. Deepest formation:	
17. Well #: 3		27. Driller's total depth: 9581 ft	
18. Lease Name: NORTHSTAR KHALIL		28. Logger's total depth: 9580 ft	
19. PTD: 9300 20. Drilling Unit: 6.7		29. Lost hole at _____ feet.	
30. Type of tools: <input type="checkbox"/> Cable <input type="checkbox"/> Air Rotary <input type="checkbox"/> Fluid Rotary <input checked="" type="checkbox"/> Air/Fluid Rotary <input type="checkbox"/> Cable/Air Rotary <input type="checkbox"/> Service Rig <input type="checkbox"/> Cable/Fluid Rotary <input type="checkbox"/> Cable/Air Rotary/Fluid Rotary		31. Type of completion:                    32. Elevation: <input checked="" type="checkbox"/> Open Hole                                      Ground Level      1036 ft <input checked="" type="checkbox"/> Through Casing                                Derrick Floor      1052 ft <input type="checkbox"/> Slotted Liner                                    Kelly Bushing     1052 ft	
33. Perforated intervals and number of shots: 0			
34. Name of Frac Company: NA			
35. Method of shot, acid, or fracture treatments, production tests, pressures, etc.:			
SHOT: _____ ACID: _____ FRAC FLUIDS: _____ SAND: _____ PRESSURES (psi): Lbs. _____ Gals. _____ Water (gals) NA Lbs. NA Breakdown NA Qts. _____ Type _____ Water (bbl) NA Sk. NA ATP NA Type _____ Percent _____ CO2 (tons) NA 5 min. SIP NA N2 (mscf) NA Avg. Rate NA			
METHOD OF FLUID CONTAINMENT FLUIDS: Swab <input type="checkbox"/> PIT: <input type="checkbox"/> FRAC TANK: <input type="checkbox"/> Flowback <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			
<div style="border: 2px solid black; padding: 5px; display: inline-block;"> <b>RECEIVED</b>  <b>FEB 16 2012</b>                      Division of Oil and Gas Resources Management                 </div> DATE TREATED: NA			
36. Amount of initial production per day:			
		(MCF.)	(Bbls.)
Natural:	Gas _____	Oil _____	Brine _____
After Treatment:	Gas 0	Oil 0	Brine 0
SERC Data:	Number of Tanks: 0	Maximum Storage Capacity of all Tanks (bbls.) 0	
37. Casing and tubing record: Please indicate which is used (cement or mudding)			
Type	Size	Feet Used in Drilling	Amount of Cement or Mud
Conductor/Drive Pipe:			Feet Left in Well
Surface:	10.75	1019	CMT 449 sks 1017
Intermediate:	7.625	8096	CMT 221 sks 8080
Production:	4.5	7972	7972
Tubing:			
Comments:			
38. Name of drilling contractor: UNION DRILLING			
39. Type of electrical and/or radioactivity logs run: (all logs must be submitted) LITHO-DENSITY, COMP. NEUTRON, GAMMA RAY,			
40. Name of logging company: SCHLUMBERGER			
<b>DIVISION USE ONLY</b>			
Log Submitted: Y / N	FRAC DATA SUBMITTED:	Well Class:	
Confidential: Y / N	Pressure/Rate Graph <input type="checkbox"/>		
	Record <input type="checkbox"/>		
	Invoice <input type="checkbox"/>		

FORMATION	TOP	BASE	Shows of oil, gas, fresh water, or brine; indicate depth or interval	REMARKS
Freshwater Strata				
Glacial Deposits				
Coal Seams				
1st Cow Run				
Buell Run				
2nd Cow Run				
Salt Sand				
Maxton Sand				
Keener Sand				
Big Injun Sand				
Squaw Sand				
Mississippian Shale				
Weir Sand				
Berea Sand				
Bedford Shale				
2nd Berea				
Ohio Shale				
Gantz				
Thirty Foot				
Gordon				
Cinnamon				
Marcellus				
Big Lime				
Sylvania				
Oriskany				
Bass Island				
Salina	4040			
Salt Section				
Newburg				
Lockport	4713			
Little Lime				
Packer Shell				
Stray Clinton	5210			
Red Clinton				
White Clinton				
Medina	5290			
Queenston	5462	7055		
Utica	7055	7348		gas shows
Trenton	7348			
Black River				
Gull River				
Glenwood Shale				
Knox Unconformity	8096			
Beekmantown				
Rose Run	8310			
Trempealeau/Copper Ridge				
"B" Zone				
Krysik				
Kerbel				
Conasauga				
Rome				
Mt. Simon	9280			
Granite Wash				
Middle Run				
Granite				



I certify that the above information is true and correct, to the best of my knowledge:

*Russell Macaw*  
(SIGNATURE)

2/15/2012  
(DATE)

Russell Macaw  
(NAME typed or printed)

Vice President - Appalachian Regional Manager  
(TITLE)

(REPRESENTING )