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west virginia department of environmental protection

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Office of Oil and Gas  
601 57th Street SE  
Charleston, WV 25304  
(304) 926-0450  
(304) 926-0452 fax

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

February 25, 2014

ANTERO RESOURCES APPALACHIAN CORPORATION  
1625 17TH STREET, SUITE 300  
DENVER, CO 80202

Re: Permit Modification Approval for API Number 3305720 , Well #: LOWNDES UNIT 1H  
**Changed Orientation of Lateral**

Oil and Gas Operator:

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

Please call James Martin at 304-926-0499, extension 1654 if you have any questions.

Sincerely,

Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas



December 11, 2013

West Virginia Department of Environmental Protection  
Office of Oil and Gas  
Attn: Ms. Laura Cooper  
601 57<sup>th</sup> Street  
Charleston, WV 25304

Antero Resources  
1625 17th Street  
Denver, Colorado 80202  
Office 303.357.7310  
Fax 303.357.7315

Ms. Laura Cooper:

Antero Resources Corporation (Antero) would like to submit the following permit modifications for two approved wells on the existing Varner West Pad. We are requesting to change the orientation of the horizontal laterals which will change the bottom hole locations of the Lowndes Unit 1H (API# 47-033-05720) and Lowndes Unit 2H (API#47-033-05719).

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the revised MD and Production Casing/Cement program
- REVISED Form WW-6A1, which shows the leases we will be drilling into
- REVISED Mylar Plat, which shows the new bottom hole location

If you have any questions please feel free to contact me at (303) 357-7323.

Thank you in advance for your consideration.

Sincerely,

Ashlie Mihalcin  
Permit Representative  
Antero Resources Corporation

Enclosures

Received

DEC 13 2013

Office of Oil and Gas  
WV Dept. of Environmental Protection

02/28/2014

WW-6B  
(9/13)

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
WELL WORK PERMIT APPLICATION

1) Well Operator: Antero Resources Corporation

<u>494488557</u>	<u>033- Harrison</u>	<u>Tenmile</u>	<u>Salem</u>
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Operator ID County District Quadrangle

2) Operator's Well Number: Lowndes Unit 1H Well Pad Name: Varner West Pad (existing)

3) Farm Name/Surface Owner: Varner, James A. Public Road Access: CR 50/6

4) Elevation, current ground: 1453' Elevation, proposed post-construction: 1453'

5) Well Type (a) Gas  Oil  Underground Storage

Other \_\_\_\_\_

(b) If Gas Shallow  Deep

Horizontal

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
Marcellus Shale: 7700' TVD, Anticipated Thickness- 50 Feet, Associated Pressure- 3200#

8) Proposed Total Vertical Depth: 7,700' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 18,500' MD

11) Proposed Horizontal Leg Length: 10,390'

12) Approximate Fresh Water Strata Depths: 135'

13) Method to Determine Fresh Water Depths: Gideon Unit 1H (API#47-033-05722) on same pad

14) Approximate Saltwater Depths: 2300'

15) Approximate Coal Seam Depths: 1064', 2020'

16) Approximate Depth to Possible Void (coal mine, karst, other): None anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes  No

(a) If Yes, provide Mine Info: Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

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Division

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(9/13)

18) CASING AND TUBING PROGRAM

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu. Ft.)</u>
Conductor	20"	New	H-40	94#	40'	40'	CTS, 38 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/ 48#	350'	350'	CTS, 486 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2480'	2480'	CTS, 1010 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	18500'	18500'	4694 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7200'	
Liners							

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20"	24"	0.438"	1530	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	Class A	1.18
Intermediate						
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12630	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11200		
Liners						

PACKERS

Kind:	N/A			
Sizes:	N/A			
Depths Set:	N/A			

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WW-6B  
(9/13)

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the well for production. The fluid will be comprised of approximately 99 percent water and sand, with less than 1 percent special-purpose additives as shown in the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 9.73 acres

22) Area to be disturbed for well pad only, less access road (acres): 5.38 acres

23) Describe centralizer placement for each casing string:

Conductor: no centralizers

Surface Casing: one centralizer 10' above the float shoe, one on the insert float collar and one every 4th joint spaced up the hole to surface.

Intermediate Casing: one centralizer above float joint, one centralizer 5' above float collar and one every 4th collar to surface.

Production Casing: one centralizer at shoe joint and one every 3 joints to top of cement in intermediate casing.

24) Describe all cement additives associated with each cement type:

Conductor: no additives, Class A cement.

Surface: Surface: Class A cement with 2-3% calcium chloride

Intermediate: Class A cement with 1/4 lb of flake, 5 gallons of clay treat

Production: Lead cement- 50/50 Class H/Poz + 1.5% salt + 1% C-45 + 0.5% C-16a + 0.2% C-12 + 0.45% C-20 + 0.05% C-51

Production: Tail cement- Class H + 45 PPS Calcium Carbonate + 1.0% FL-160 + 0.2% ACGB-47 + 0.05% ACSA-51 + 0.2% ACR-20

25) Proposed borehole conditioning procedures:

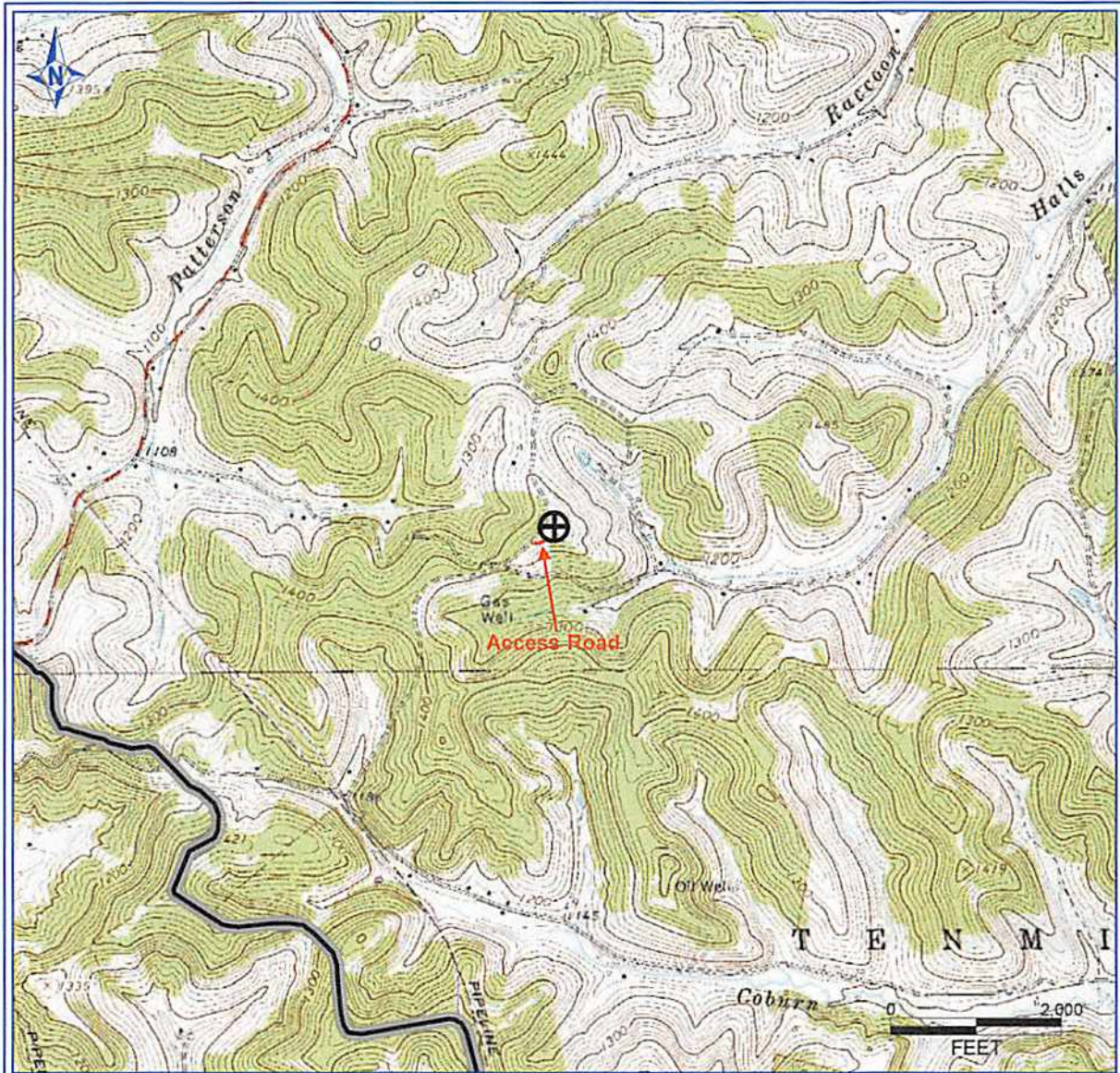
Conductor: blowhole clean with air, run casing, 10 bbls fresh water.

Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.

Intermediate: blowhole clean with air, trip to surface casing shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate 40 bbls brine water followed by 10 bbls fresh water and 25 bbls bentonite mud, pump 10 bbls fresh water.

Production: circulate with 14 lb/gal NaCl mud, trip to middle of lateral, circulate, pump high viscosity sweep, trip to base of curve, pump high viscosity sweep, trip to top of curve, trip to bottom, circulate, pump high viscosity sweep, trip out, run casing, circulate 10 bbls fresh water, pump 48 bbls barite pill, pump 10 bbls fresh water followed by 48 bbls mud flush and 10 bbls water.

\*Note: Attach additional sheets as needed.



PETRA 12/19/2012 2:51:43 PM

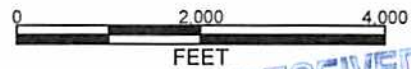
33-05720 H6A      LOWNDES UNIT 1H  
ANTERO RESOURCES CORP

PAD NAME: VARNER WEST

Antero Resources Corporation

APPALACHIAN BASIN

Lowndes Unit 1H  
Harrison County



REMARKS  
QUADRANGLE: SALEM  
WATERSHED: HALLS RUN  
DISTRICT: TENMILE

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Department of Oil & Gas  
DEC 27 2012

Date: 12/19/2012

Department of  
Environmental Protection



**Antero Resources**  
**Well No. Lowndes Unit 1H**  
**Antero Resources Corporation**

**Notes:**  
 West Virginia Coordinate System of 1927, North Zone based upon Differential GPS Measurements.  
 Well No. Lowndes Unit 1H Top Hole coordinates are  
 N: 276,553.06' Latitude: 39°15'16.40"  
 E: 1,703,421.29' Longitude: 80°32'50.39"  
 Bottom Hole coordinates are  
 N: 285,786.27' Latitude: 39°16'47.20"  
 E: 1,699,462.35' Longitude: 80°33'42.10"  
**UTM Zone 17, NAD 1983**  
 Top Hole Coordinates Bottom Hole Coordinates  
 N: 4,345,132.962m N: 4,347,925.776m  
 E: 539,072.216m E: 537,819.248m  
 Plat orientation and corner and well references are based upon the grid north meridian.  
 Well location references are based upon the magnetic meridian.

**Legend**

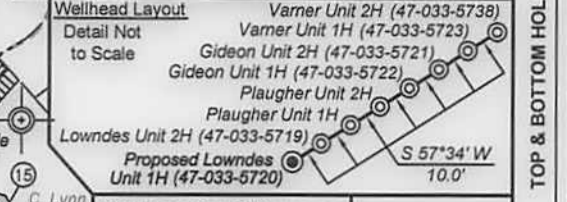
- Proposed gas well
- Found monument, as noted
- Existing Well (as noted)
- Creek or Drain
- Existing Road
- Surface boundary (approx.)
- Interior surface tracts (approx.)
- Existing Fenceline

5,720' to Bottom Hole

1,761' to Top Hole

**TOP & BOTTOM HOLE LATITUDE 39 - 17 - 30**

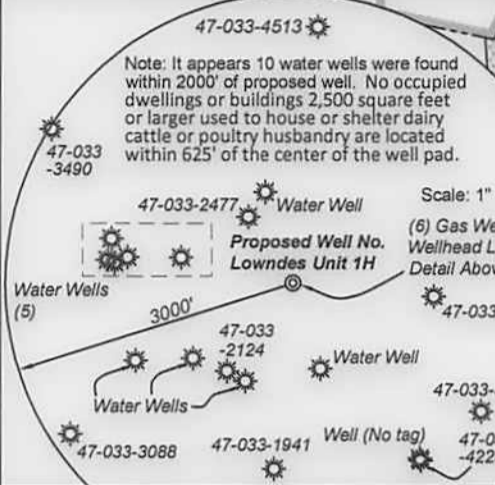
Par	Tax Map 301 Owner	Bk/Pg	Acres
23	71 Greg L. & Shelly Jenkins and Larry B. & Patricia Jenkins	1275/220	0.14
24	47 City of Salem	774/59	0.18
25	46 City of Salem	194/259	27x54'
26	44 Sharon K. Snider	1233/970	5.75
27	84.1 Charles Kenna Williams	1262/1047	0.54
28	48 City of Salem	356/126	80x80'
29	49 Paul & Maxine Flanigan	1063/632	10.5
30	67.1 Leroy E. & Sonia Key	1259/820	0.04
31	69 Emma R. Hendershot	1373/42	0.13



**Well Location References**  
 Scale: 1" = 200'

Proposed Well No. Lowndes Unit 1H

Line	Bearing	Dist.
L1	S 31°04' E	772.3'
L2	N 69°25' E	823.4'
L3	N 33°26' E	1128.4'
L4	S 72°51' W	1910.2'
L5	S 55°16' W	1318.3'



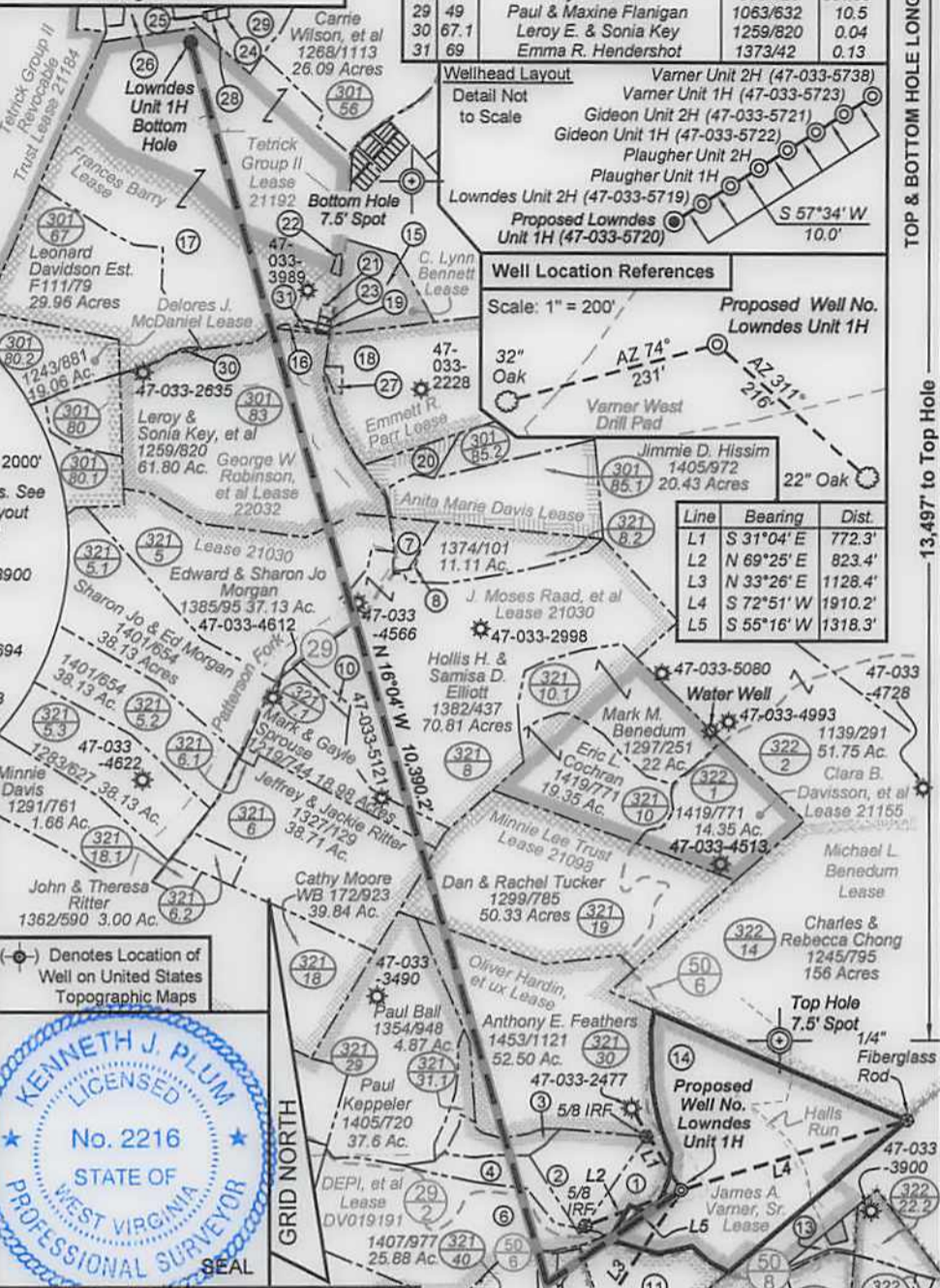
Par	Tax Map 321 Owner	Bk/Pg	Acres
1	31.2 Patrick J. Shaver	1427/445	5.00
2	31.4 Dan Arnold & Crystal Shahan	1268/976	9.55
3	31.3 Robert Jr. & Betty Matheny	1114/163	3.53
4	31 Carl H. Jr. & Jeanne Adkins	1356/1050	2.35
5	40.4 Clifford & Laura Cleavenger	1406/1196	1.06
6	39 John & Marianne Cleavenger	1247/289	33.35
7	9 Archie T. & Patricia A. Howell	1026/474	2.10
8	8.1 Archie T. & Patricia A. Howell	1232/729	0.08
9	40.3 Clifford & Laura Cleavenger	1085/605	0.81
10	7 Edward & Sharon Morgan	1385/95	1.02

Par	Tax Map 322 Owner	Bk/Pg	Acres
11	19 David B. Taylor	1301/1069	14.0
12	20 James A. Varnor	1199/860	16.63
13	21.1 James A. Varnor	1261/953	1.45
14	18 James A. Varnor	1261/953	65.45

Par	Tax Map 301 Owner	Bk/Pg	Acres
15	73.1 Lynn C. Bennett and Robert L. & Mary A. Martin	WB113/200	9.43
16	68.2 Leroy E. & Sonia Key	1259/820	0.24
17	50 Ralph W. & Mary E. Stanton	1321/394	97.4
18	84 June C. Williams	1083/604	36.28
19	70 Michael Stephen & Victoria Ann Davis	1255/102	0.11
20	85.3 Tina M. & Bobby L. Yeager	1309/412	3.28
21	72 Alice A. & Jimmy Criss	F111/825	0.23
22	68.1 William R. & Verna L. Evans	917/476	0.22



I, the undersigned, hereby certify that this plat is correct to the best of my knowledge and belief and shows all the information required by law and the rules issued and prescribed by the Department of Environmental Protection.

*Kenneth J. Plum*  
 Kenneth J. Plum, P.S. 2216

FILE NO: 10-36-TM-12  
 DRAWING NO: 10-12 Lowndes 1H Well Plat  
 SCALE: 1" = 1500'  
 MINIMUM DEGREE OF ACCURACY: Submeter  
 PROVEN SOURCE OF ELEVATION: WVDOT, Bridgeport, WV

**STATE OF WEST VIRGINIA**  
 DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**OIL AND GAS DIVISION**

DATE: September 24 2013  
 OPERATORS WELL NO. Lowndes Unit 1H  
 API WELL NO MOD  
 47 - 033 - 25720 H6A  
 STATE COUNTY PERMIT

WELL TYPE:  OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  
 (IF GAS) PRODUCTION:  STORAGE  DEEP  SHALLOW  
 LOCATION: ELEVATION: 1453' WATERSHED: Halls Run QUADRANGLE: Salem  
 DISTRICT: Tenmile Frances Barry, Tetrick Group II COUNTY: Harrison  
 SURFACE OWNER: James A. Varnor Minnie Lee Trust; George W. Robinson, et al 22032; 21192 ACREAGE: 65.45  
 ROYALTY OWNER: James A. Varnor, Sr.; DEPI, et al; Gideon Thompson, et ux 21030; 044999 ACREAGE: 70.866; 60.5  
 PROPOSED WORK:  DRILL  CONVERT  DRILL DEEPER  FRACTURE OR STIMULATE  PLUG OFF OLD FORMATION  
 PERFORATE NEW FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Mod-BHL  
 PLUG AND ABANDON  CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 18,500' MD 7,700' TVD

WELL OPERATOR: Antero Resources Corporation DESIGNATED AGENT: Dianna Stamper - CT Corporation System  
 ADDRESS: 1625 17th Street ADDRESS: 5400 D Big Tyler Road  
 Denver, CO 80202 Charleston, WV 25313