



---

west virginia department of environmental protection

---

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 06, 2014

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

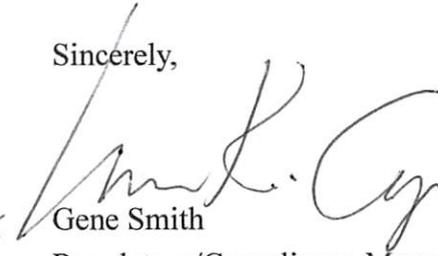
Re: Permit Modification Approval for API Number 1706207 , Well #: SHALE UNIT 2H  
**Extended lateral**

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,

*for*   
Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas

Promoting a healthy environment.

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 494488557 033- Harrison Tenmile Salem  
Operator ID County District Quadrangle

2) Operator's Well Number: Shale Unit 2H Well Pad Name: Jonathan Davis Pad (existing)

3) Farm Name/Surface Owner: Jonathan L. Davis Public Road Access: CR 11

4) Elevation, current ground: 1146' Elevation, proposed post-construction: 1146'

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: 6950' TVD, Anticipated Thickness- 60 feet, Associated Pressure- 3,100#

8) Proposed Total Vertical Depth: 6,950' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 15,800' MD

11) Proposed Horizontal Leg Length: 7681'

12) Approximate Fresh Water Strata Depths: 148', 340'

13) Method to Determine Fresh Water Depths: Offset well records. Depths have been adjusted according to surface elevations.

14) Approximate Saltwater Depths: 675', 1581'

15) Approximate Coal Seam Depths: 824'

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: \_\_\_\_\_

RECEIVED  
Office of Oil and Gas

DEC 13 2013

WW-6B  
(9/13)

18) CASING AND TUBING PROGRAM

TYPE	Size	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling	INTERVALS: Left in Well	CEMENT: Fill-up (Cu. Ft.)
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#	395'	395'	CTS, 549 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2475'	2475'	CTS, 1008 Cu Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	15800'	15800'	3936 Cu Ft.
Tubing	2-3/8"	New	N-80	4.7#		6900'	
Liners							

CKC  
2.6.14

TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./k)
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			

RECEIVED  
Office of Oil and Gas  
DEC 10 2013  
Department of  
Environmental Protection

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): 24.44 acres existing

22) Area to be disturbed for well pad only, less access road (acres): 7.42 acres existing

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: 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:

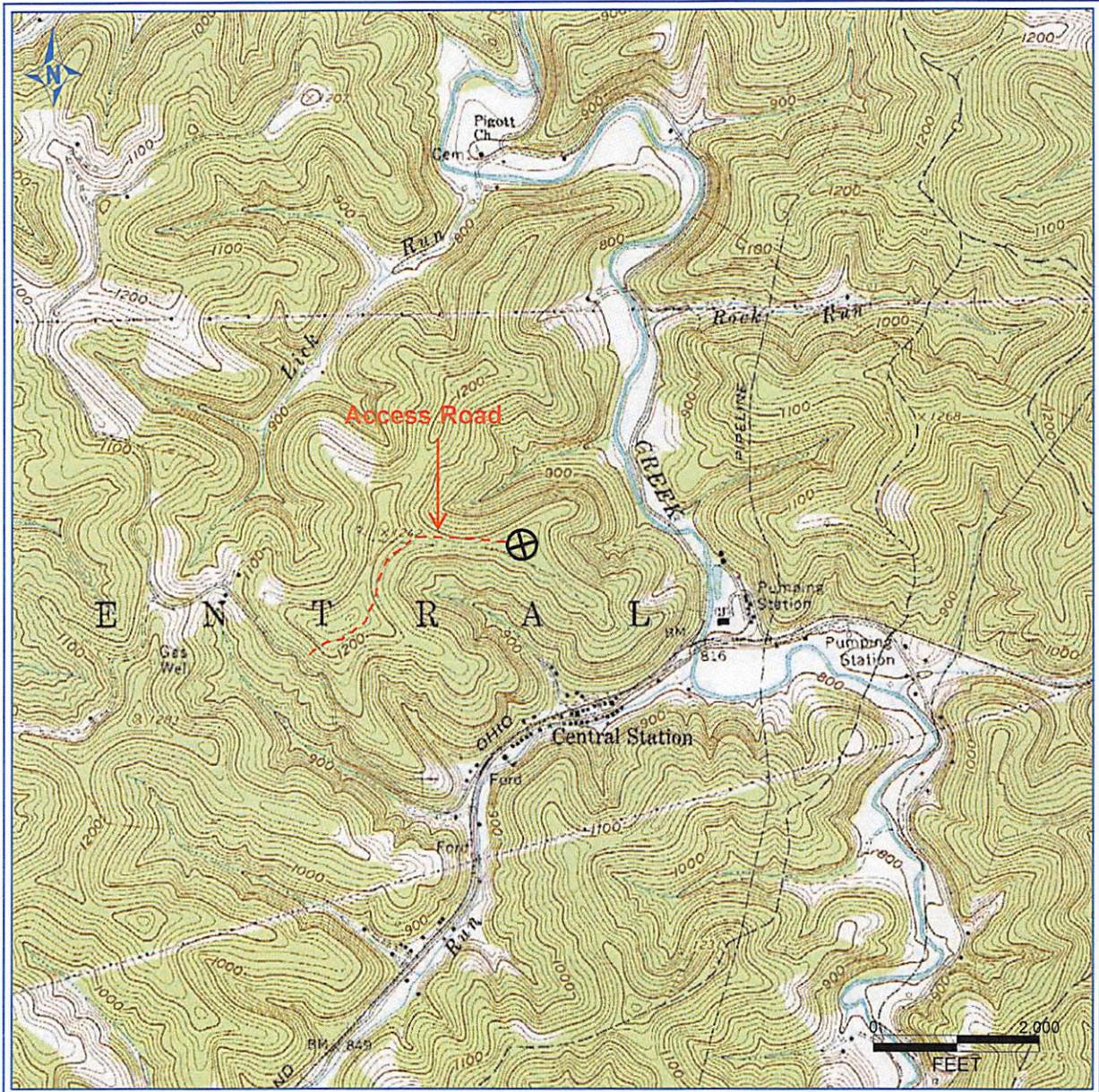
Conductor: blowhole clean with air, run casing, 10 bbls fresh water.

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 1/29/2013 2:00:06 PM

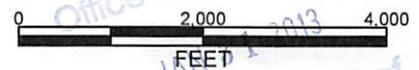
17-06207 H6A SHALE UNIT 2H  
 ANTERO RESOURCES CORP

PAD NAME: EXISTING JONATHAN DAVIS

Antero Resources Corporation

APPALACHIAN BASIN

Shale Unit 2H  
 Doddridge County, WV



REMARKS  
 QUADRANGLE: WEST UNION  
 WATERSHED: ARNOLD CREEK  
 DISTRICT: CENTRAL

January 29, 2013

LATITUDE 39°20'00"

10,510'

2,274' TO BOTTOM HOLE

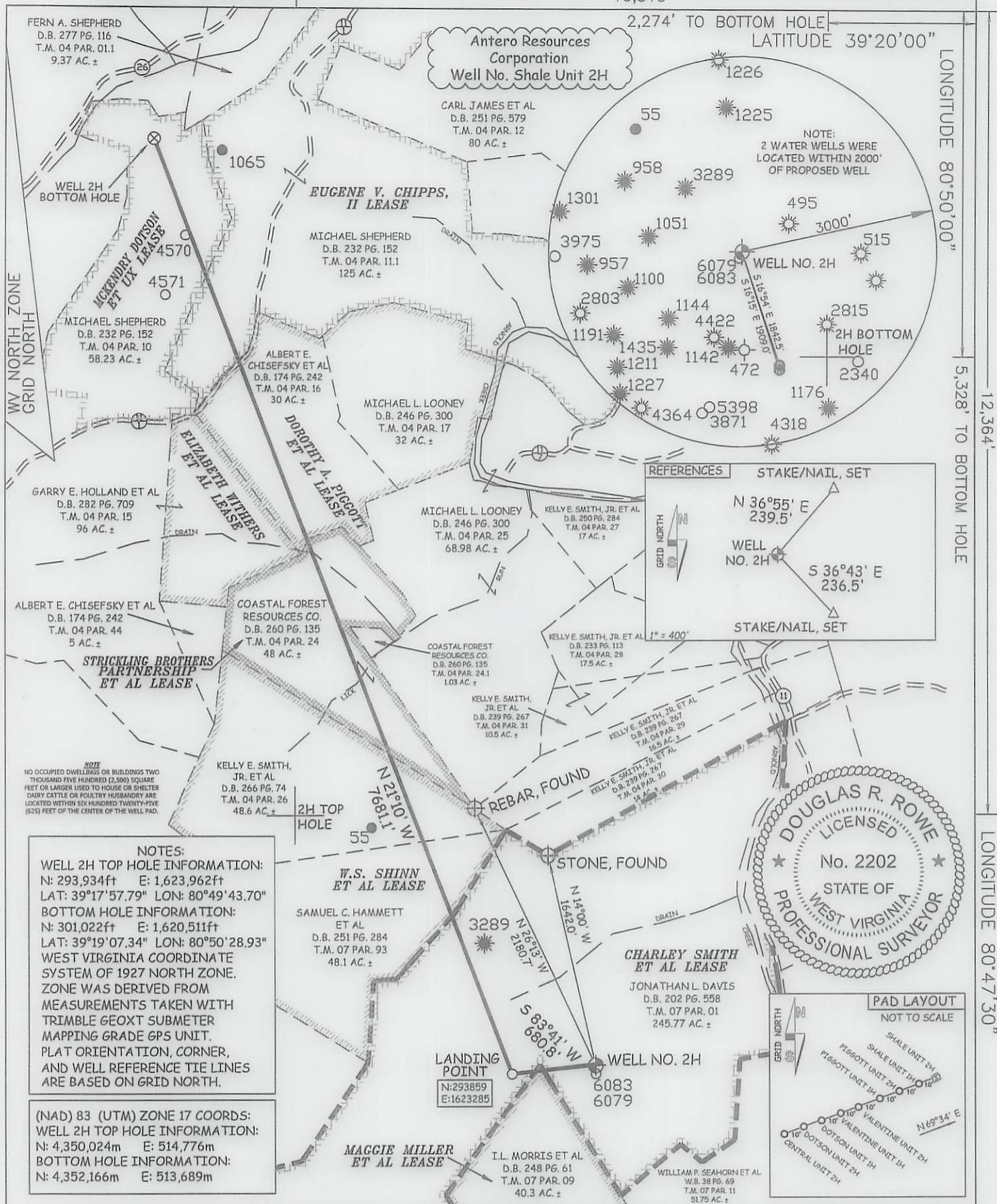
LATITUDE 39°20'00"

LONGITUDE 80°50'00"

12,364'

5,328' TO BOTTOM HOLE

LONGITUDE 80°47'30"



**NOTES:**  
 WELL 2H TOP HOLE INFORMATION:  
 N: 293,934ft E: 1,623,962ft  
 LAT: 39°17'57.79" LON: 80°49'43.70"  
 BOTTOM HOLE INFORMATION:  
 N: 301,022ft E: 1,620,511ft  
 LAT: 39°19'07.34" LON: 80°50'28.93"  
 WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE. ZONE WAS DERIVED FROM MEASUREMENTS TAKEN WITH TRIMBLE GEOXT SUBMETER MAPPING GRADE GPS UNIT. PLAT ORIENTATION, CORNER, AND WELL REFERENCE TIE LINES ARE BASED ON GRID NORTH.

(NAD) 83 (UTM) ZONE 17 COORDS:  
 WELL 2H TOP HOLE INFORMATION:  
 N: 4,350,024m E: 514,776m  
 BOTTOM HOLE INFORMATION:  
 N: 4,352,166m E: 513,689m

JOB # 12-163WA  
 DRAWING # SHALE2HR1  
 SCALE 1" = 1000'  
 MINIMUM DEGREE OF ACCURACY SUBMETER  
 PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS

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.



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
 WILLOW LAND SURVEYING PLLC  
 220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415

**LEGEND**  
 - - - Surface Owner Boundary Lines +/-  
 - - - Interior Surface Tracts +/-  
 X Existing Fence  
 ⊕ Found monument, as noted

DOUGLAS R. ROWE P.S. 2202

DATE 10/16/13  
 OPERATOR'S WELL# SHALE UNIT #2H  
 API WELL # 47-017  
 STATE COUNTY PERMIT

MOD 06207 HGA  
 COUNTY NAME PERMIT

STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS  
 WELL TYPE: OIL \_\_\_ GAS X LIQUID INJECTION \_\_\_ WASTE DISPOSAL \_\_\_  
 (IF "GAS") PRODUCTION X STORAGE \_\_\_ DEEP \_\_\_ SHALLOW X  
 LOCATION: ELEVATION 1,146' WATERSHED ARNOLD CREEK  
 QUADRANGLE WEST UNION 7.5' DISTRICT CENTRAL COUNTY DODDRIDGE  
 SURFACE OWNER JONATHAN L. DAVIS ACREAGE 245.77 ACRES +/-  
 OIL & GAS ROYALTY OWNER CHARLEY SMITH ET AL; MAGGIE MILLER ET AL; W.S. SHINN ET AL; LEASE ACREAGE 213 ACRES+; 40 ACRES+; 84 ACRES+;  
 STRICKLING BROTHERS PARTNERSHIP ET AL; DOROTHY A. PIGGOTT ET AL; EUGENE V. CHIPPS, II; MCKENDRY DOTSON ET UX 58.05 ACRES+; 62 ACRES+; 140 ACRES+; 60 ACRES+  
 PROPOSED WORK: DRILL X CONVERT \_\_\_ DRILL DEEPER \_\_\_ REDRILL \_\_\_ FRACTURE OR STIMULATE X  
 PLUG OFF OLD FORMATION \_\_\_ PERFORATE NEW FORMATION X OTHER PHYSICAL CHANGE IN WELL  
 (SPECIFY) Modification - BHL - Extend Lateral PLUG & ABANDON CLEAN OUT & REPLUG  
 TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,950' TVD 15,800' MD  
 WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER  
 ADDRESS 1625 17TH STREET ADDRESS 5400 D BIG TYLER ROAD  
 FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313