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west virginia department of environmental protection

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Office of Oil and Gas  
601 57<sup>th</sup> Street, S.E.  
Charleston, WV 25304  
(304) 926-0450  
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

Wednesday, March 14, 2018  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for SCORPIO UNIT 2H  
47-017-06861-00-00

ANTERO RESOURCES CORPORATION

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.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin  
Chief

Operator's Well Number: SCORPIO UNIT 2H  
Farm Name: MATTHEW W. ALEXANDER & LINDA MARIE M  
U.S. WELL NUMBER: 47-017-06861-00-00  
Horizontal 6A New Drill  
Date Modification Issued: 03/14/2018

Promoting a healthy environment.

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

1) Well Operator: Antero Resources Corporation 494507062 017-Doddridge West Union West Union 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Scorpio Unit 2H Well Pad Name: Alexander Pad

3) Farm Name/Surface Owner: Matthew W. Alexander & Linda Marie Muhly Public Road Access: CR 28 (Nutter Fork)

4) Elevation, current ground: ~1195' Elevation, proposed post-construction: 1181'

5) Well Type (a) Gas X Oil \_\_\_\_\_ Underground Storage \_\_\_\_\_

Other \_\_\_\_\_

(b) If Gas Shallow X Deep \_\_\_\_\_

Horizontal X

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):  
Marcellus Shale: 7500' TVD, Anticipated Thickness- 60 feet, Associated Pressure- 3100#

8) Proposed Total Vertical Depth: 7500' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 17200' MD

11) Proposed Horizontal Leg Length: 9142'

12) Approximate Fresh Water Strata Depths: 292', 297', 455'

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

14) Approximate Saltwater Depths: 1319', 1896', 2061'

15) Approximate Coal Seam Depths: 677', 839'

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 X

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

WW-6B  
(04/15)

PERMIT MODIFICATION AP# 47-017-06861

API NO. 47- 017 - 06861

OPERATOR WELL NO. Scorpio Unit 2H

Well Pad Name: Alexander Pad

18)

**CASING AND TUBING PROGRAM**

| <b>TYPE</b>  | <b>Size (in)</b> | <b>New or Used</b> | <b>Grade</b> | <b>Weight per ft. (lb/ft)</b> | <b>FOOTAGE: For Drilling (ft)</b> | <b>INTERVALS: Left in Well (ft)</b> | <b>CEMENT: Fill-up (Cu. Ft.)/CTS</b> |
|--------------|------------------|--------------------|--------------|-------------------------------|-----------------------------------|-------------------------------------|--------------------------------------|
| Conductor    | 20"              | New                | H-40         | 94#                           | 80'                               | 80'                                 | CTS, 77 Cu. Ft.                      |
| Fresh Water  | 13-3/8"          | New                | J-55         | 54.5#                         | 505' *see #19                     | 505' *see #19                       | CTS, 702 Cu. Ft.                     |
| Coal         | 9-5/8"           | New                | J-55         | 36#                           | 2500'                             | 2500'                               | CTS, 1018 Cu. Ft.                    |
| Intermediate |                  |                    |              |                               |                                   |                                     |                                      |
| Production   | 5-1/2"           | New                | P-110        | 23#                           | 17200'                            | 17200'                              | 4322 Cu. Ft                          |
| Tubing       | 2-3/8"           | New                | N-80         | 4.7#                          |                                   | 7100'                               |                                      |
| Liners       |                  |                    |              |                               |                                   |                                     |                                      |

| <b>TYPE</b>  | <b>Size (in)</b> | <b>Wellbore Diameter (in)</b> | <b>Wall Thickness (in)</b> | <b>Burst Pressure (psi)</b> | <b>Anticipated Max. Internal Pressure (psi)</b> | <b>Cement Type</b> | <b>Cement Yield (cu. ft./k)</b> |
|--------------|------------------|-------------------------------|----------------------------|-----------------------------|---|--------------------|---------------------------------|
| Conductor    | 20"              | 24"                           | 0.438"                     | 1530                        | 50  | Class A            | ~1.18                           |
| Fresh Water  | 13-3/8"          | 17-1/2"                       | 0.38"                      | 2730                        | 1000  | Class A            | ~1.18                           |
| Coal         | 9-5/8"           | 12-1/4"                       | 0.352"                     | 3520                        | 1500  | Class A            | ~1.18                           |
| Intermediate |                  |                               |                            |                             |   |                    |                                 |
| Production   | 5-1/2"           | 8-3/4" & 8-1/2"               | 0.415"                     | 12,630                      | 2500  | Lang-HPOZ & Tar-H  | H/POZ~1.44 & H~1.8              |
| Tubing       | 2-3/8"           | 4.778"                        | 0.19"                      | 11,200                      |   |                    |                                 |
| Liners       |                  |                               |                            |                             |   |                    |                                 |

**PACKERS**

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

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WW-6B  
(10/14)

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.

\*Antero will be air drilling the fresh water string which makes it difficult to determine when fresh water is encountered. Therefore, we have built in a buffer for the casing setting depth which helps to ensure that all fresh water zones are covered.

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."

Anticipated Max Pressure - 9300 lbs  
Anticipated Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 24.40 acres

22) Area to be disturbed for well pad only, less access road (acres): 6.10 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: Class A cement with 2-3% calcium chloride and 1/4 lb of flake

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

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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.

11,010' to Bottom Hole  
7,401' to Top Hole  
LATITUDE 39 - 22 - 30  
LONGITUDE 80 - 45 - 00  
5,687' to Bottom Hole  
14,182' to Top Hole

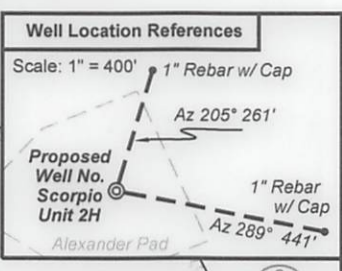
**Antero Resources**  
**Well No. Scorpio Unit 2H**  
**Antero Resources Corporation**

| Bearing       | Dist.   |
|---------------|---------|
| L1 S 84°07' W | 311.3'  |
| L2 N 43°40' W | 795.1'  |
| L3 N 64°18' W | 676.9'  |
| L4 S 37°32' W | 1062.3' |
| L5 S 72°36' E | 1215.3' |

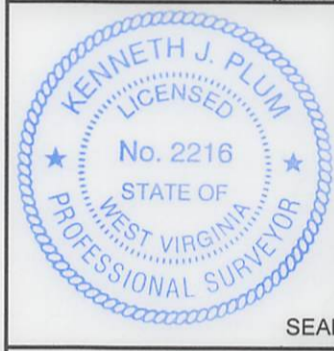
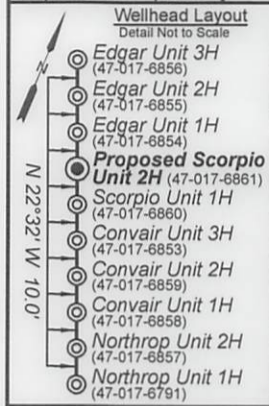
David R. & Elizabeth A. Beveridge  
247/566  
11.9 Ac.

(+ ) Denotes Location of Well on United States Topographical Maps

Nick Petrovich  
232/686 70 Ac.



**Notes:**  
West Virginia Coordinate System of 1927, North Zone based upon Differential GPS Measurements.  
Well No. Scorpio Unit 2H Top Hole coordinates are  
N: 306,969.34' Latitude: 39°20'08.81"  
E: 1,639,243.30' Longitude: 80°46'31.67"  
Bottom Hole coordinates are  
N: 315,463.61' Latitude: 39°21'32.25"  
E: 1,635,634.43' Longitude: 80°47'19.15"  
UTM Zone 17, NAD 1983  
Top Hole Coordinates Bottom Hole Coordinates  
N: 4,354,072.918m N: 4,356,642.348m  
E: 519,365.567m E: 518,222.948m  
Plat orientation and corner and well references are based upon the grid north meridian.  
Well location references are based upon the magnetic meridian.



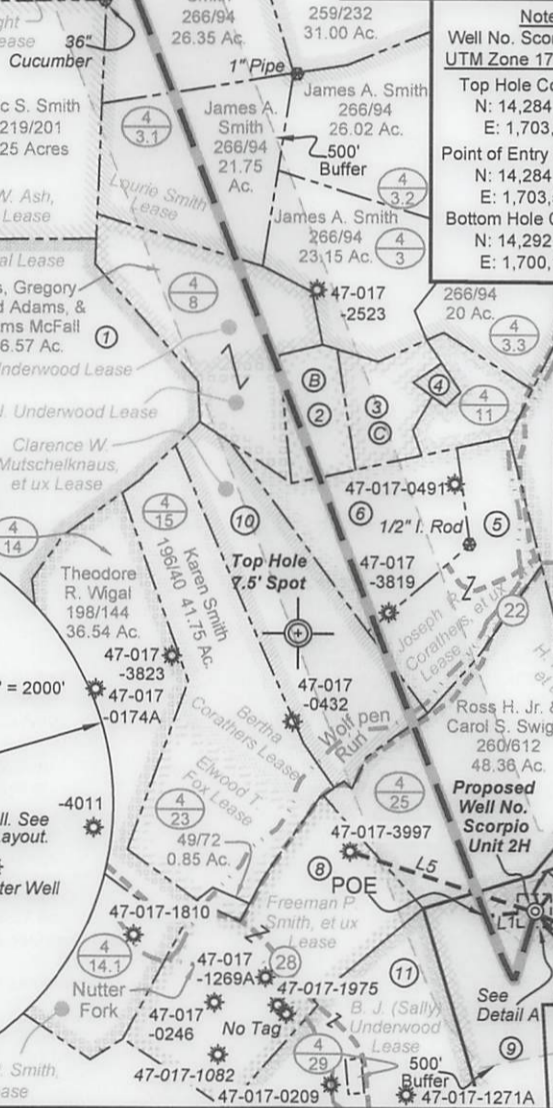
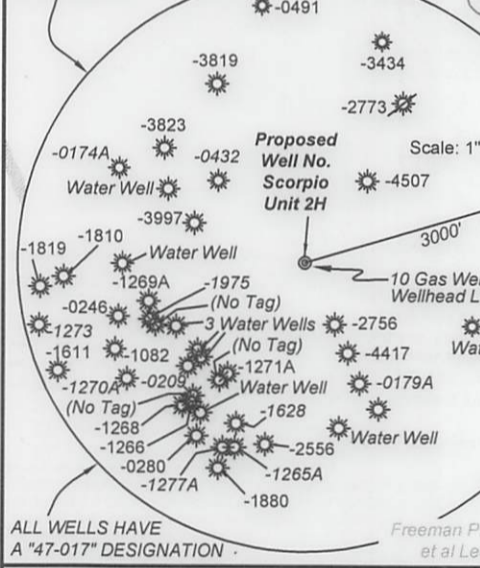
**I, the undersigned, hereby certify that this plat is correct to the best of my knowledge and belief and shows all the information required by law and the rules issued and prescribed by the Department of Environmental Protection.**

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

**Legend**

- Proposed gas well
- Found corner, as noted
- Creek or Drain
- Existing Road
- Surface boundary (approx.)
- Surface tracts (approx.)
- Well (as noted)
- Well (plugged)

Note: It appears 9 water wells were found within 2000' of proposed well. No occupied dwellings or buildings 2,500 square feet or larger used to house or shelter dairy cattle or poultry husbandry are located within 625' of the center of the well pad.



**Notes:**  
Well No. Scorpio Unit 2H UTM Zone 17, NAD 1927  
Top Hole Coordinates  
N: 14,284,272.67'  
E: 1,703,904.56'  
Point of Entry Coordinates  
N: 14,284,235.59'  
E: 1,703,595.55'  
Bottom Hole Coordinates  
N: 14,292,702.62'  
E: 1,700,155.80'

| Par. | Bk/Pg | Acres   | TM 4 Surface Owner(s)   |
|------|-------|---------|---|
| 1    | 7     | 270/415 | 245.38 Donley Kent Shultz & Jeannette L. Lowther Shultz               |
| 2    | 9     | 282/181 | 7.16 Scott Adams, Gregory Adams, David Adams, & Jennifer Adams McFall |
| 3    | 10    | 282/181 | 7.91  |
| 4    | 2     | 282/181 | 0.90  |
| 5    | 17.1  | 299/145 | 20.44 Bryan Edwin & Patricia Natalie Hagedorn                         |
| 6    | 17    | 256/621 | 19.70 David P. & Melissa A. Smith                                     |
| 7    | 32.1  | 349/322 | 20.0 Andy H. & Carrie Kurtz   |
| 8    | 24    | 248/254 | 35.34 Karen Ann Smith   |
| 9    | 32    | 241/412 | 43.94 Matthew W. Alexander & Linda Marie Muhly                        |
| 10   | 16    | 248/254 | 26.01 Karen Ann Smith   |
| 11   | 30    | 211/302 | 30.50 Kathryn J. Sisler, et al  |
| 4    | 18    | 194/667 | 71.5 Ac. Silas Spencer, et ux Lease                                   |

**Lease Table**

| Lease | Owner  |
|-------|--|
| A     | Charles Williams by Randy Williams, A.I.F. Lease |
| B     | John Yutzky Lease                                |
| C     | Delbert Ray Ash Lease                            |

FILE NO: 41-30-WU-14  
DRAWING NO: Scorpio 2H Well Plat 11-16  
SCALE: 1" = 1200'  
MINIMUM DEGREE OF ACCURACY: Submeter  
PROVEN SOURCE OF ELEVATION: WVDOT, Harrisville, WV

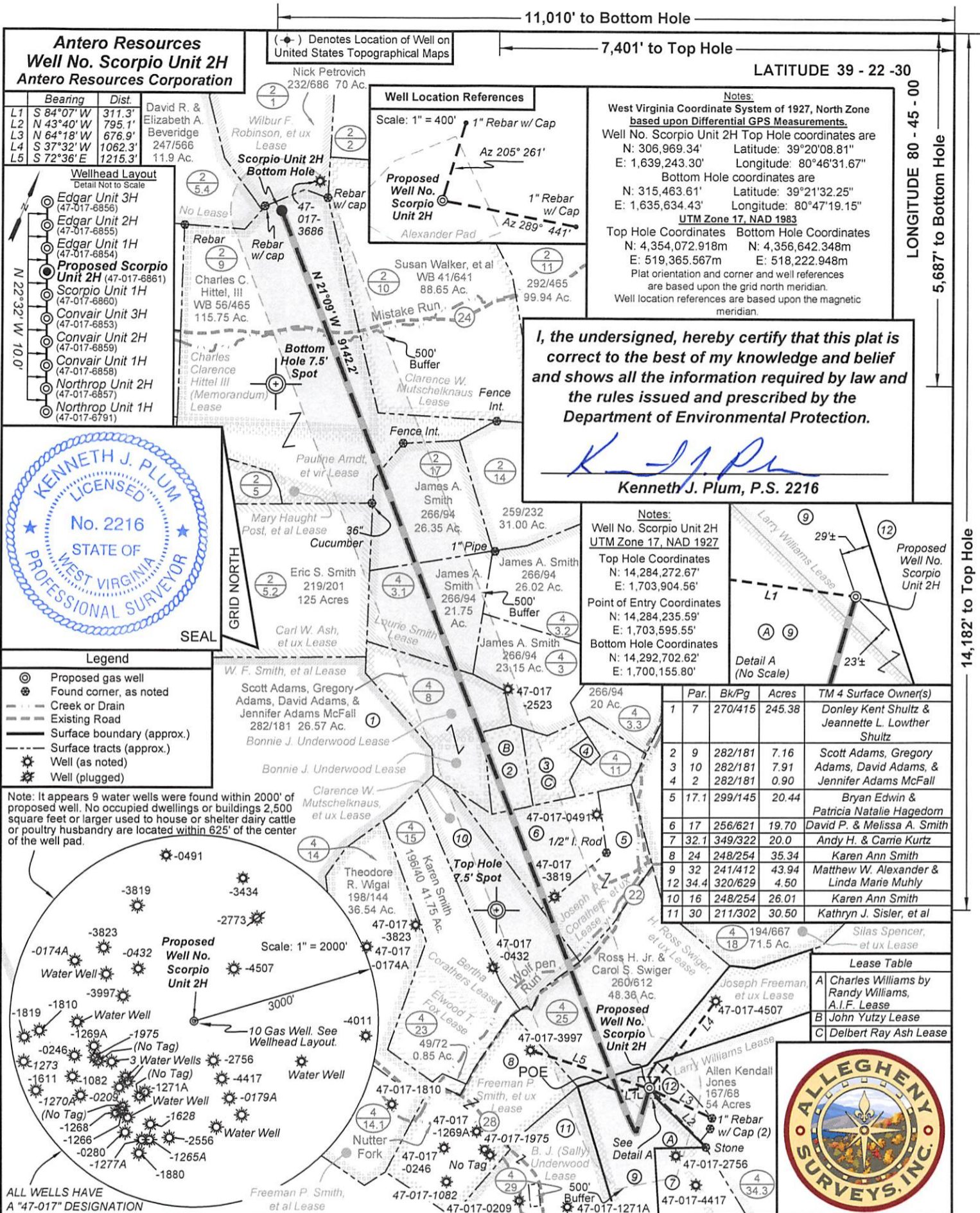
**STATE OF WEST VIRGINIA**  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**OIL AND GAS DIVISION**

DATE: November 15, 20 17  
Operator's Well No. Scorpio Unit 2H  
API WELL NO  
47 - 017 - 06861  
STATE COUNTY PERMIT

WELL TYPE:  OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  
(IF GAS) PRODUCTION:  STORAGE  DEEP  SHALLOW  
Existing Grade - 1201'  
Proposed Grade - 1181'  
LOCATION: ELEVATION: WATERSHED: Headwaters Middle Island Creek QUADRANGLE: West Union  
DISTRICT: West Union COUNTY: Doddridge 428.51; 28  
SURFACE OWNER: Matthew W. Alexander & Linda Marie Muhly John Yutzky; Lourie Smith; Clarence W. Mutschelknaus, et ux; Larry Williams; Joseph R. Corathers, et ux; H. Ross Swiger, et ux; Bonnie J. Underwood (2); Pauline Arndt, et vir LEASE NO: ACREAGE: 43.94 48.36; 7.16 59; 19.5; 7  
ROYALTY OWNER: Charles Clarence Hittel III (Memorandum); Charles Williams by Randy Williams, A.I.F. LEASE NO: ACREAGE: 84.25; 31; 115; 67  
PROPOSED WORK:  DRILL  CONVERT  DRILL DEEPER  FRACTURE OR STIMULATE  PLUG OFF OLD FORMATION  
 PERFORATE NEW FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Modification - Add Curve to POE 7,500' TVD  
 PLUG AND ABANDON  CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 17,200' MD

WELL OPERATOR: Antero Resources Corporation DESIGNATED AGENT: Dianna Stamper - CT Corporation System  
ADDRESS: 1615 Wynkoop Street ADDRESS: 5400 D Big Tyler Road  
Denver, CO 80202 Charleston, WV 25313





FILE NO: 41-30-WU-14  
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SCALE: 1" = 1200'  
MINIMUM DEGREE OF ACCURACY: Submeter  
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**STATE OF WEST VIRGINIA**  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**OIL AND GAS DIVISION**

DATE: November 15, 20 17  
Operator's Well No. Scorpio Unit 2H  
API WELL NO 47 - 017 - 00884ED  
STATE COUNTY Office of Oil and Gas PERMIT

WELL TYPE:  OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  
(IF GAS) PRODUCTION:  STORAGE  DEEP  SHALLOW  
LOCATION: ELEVATION: Existing Grade - 1201' Proposed Grade - 1181' WATERSHED: Headwaters Middle Island Creek QUADRANGLE: West Union, WV  
DISTRICT: West Union COUNTY: Doddridge  
SURFACE OWNER: Matthew W. Alexander & Linda Marie Muhly John Yutzy; Lourie Smith Clarence W. Mutschelknaus, et ux; Larry Williams Joseph R. Corathers, et ux; H. Ross Swiger, et ux Bonnie J. Underwood (2); Pauline Arndt, et vir ACREAGE: 43.94 428.51; 28 48.36; 7.16 59; 19.5; 7  
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 PERFORME NEW FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Modification - Add Curve to POE  
 PLUG AND ABANDON  CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 7,500' TVD 17,200' MD

WELL OPERATOR: Antero Resources Corporation DESIGNATED AGENT: Dianna Stamper - CT Corporation System  
ADDRESS: 1615 Wynkoop Street ADDRESS: 5400 D Big Tyler Road  
Denver, CO 80202 Charleston, WV 25313



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



DEC 4 2017