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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 NORTHROP UNIT 2H  
47-017-06857-00-00

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: NORTHROP UNIT 2H  
Farm Name: MATTHEW W. ALEXANDER & LINDA MARIE M  
U.S. WELL NUMBER: 47-017-06857-00-00  
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 Corporat 494507062 017-Doddrid West Uni West Union 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Northrop 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#

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8) Proposed Total Vertical Depth: 7500' TVD

9) Formation at Total Vertical Depth: Marcellus

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10) Proposed Total Measured Depth: 16400' MD

11) Proposed Horizontal Leg Length: 8436'

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

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

Depth: \_\_\_\_\_

Seam: \_\_\_\_\_

Owner: \_\_\_\_\_

WW-6B  
(04/15)

PERMIT MODIFICATION API# 47-017-06857

API NO. 47- 017 - 06857

OPERATOR WELL NO. Northrop Unit 2H

Well Pad Name: Alexander Pad

18)

**CASING AND TUBING PROGRAM**

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
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#	16400'	16400'	4102 Cu. Ft
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
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	Lead-HPOZ & Tail - 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)

PERMIT MODIFICATION API# 47-017-06857

API NO. 47- 017 - 06857

OPERATOR WELL NO. Northrop Unit 2H

Well Pad Name: Alexander Pad

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.

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE  
Chapter 22, Article 6A, Section 5(a)(5)  
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

(1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;

(2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<b><u>Larry Williams Lease</u></b>			
Larry Williams	Antero Resources Appalachian Corporation	1/8+	0267/0352
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Charles Williams by Randy Williams, A.I.F. Lease</u></b>			
Charles Williams by Randy Williams, A.I.F.	Drilling Appalachian Corporation	1/8	LB0181/0615
Drilling Appalachian Corporation	Antero Resources Appalachian Corporation	Assignment	LB0262/0600
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>H. Ross Swiger, et ux Lease</u></b>			
H. Ross Swiger, Jr., et ux	Honor Resources Company	1/8	0295/0480
Honor Resources Company	EXCO Production Company, LLC; BG Production Company, LLC; EXCO Resources, LLC	Assignment	0299/0659
EXCO Production Company, LLC; BG Production Company, LLC; EXCO Resources, LLC	Antero Resources Appalachian Corporation	Assignment	0301/0551
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Joseph Freeman, et ux Lease</u></b>			
Joseph Freeman	G.H. Trainer & J.E. Trainer	1/8	0027/0233
G.H. Trainer & J.E. Trainer	W.W. Hepburn	Assignment	0034/0244
W.W. Hepburn	Eastern Petroleum Company	Assignment	0034/0256
Eastern Petroleum Company	Clifton Oil & Gas Company	Assignment	0041/0431
Clifton Oil & Gas Company	Quaker State Refining Corporation	Assignment	0056/0165
Quaker State Refining Corporation	QSE&P, Inc.	Assignment	0159/0474
QSE&P, Inc.	The Quaker State 1989-1 Drilling Fund, L.P.	Assignment	0160/0200
The Quaker State 1989-1 Drilling Fund, L.P.	Belden & Blake Corporation	Assignment	0175/0466
Belden & Blake Corporation	Peake Energy, Inc.	Assignment	0181/0567
Peake Energy, Inc.	North Coast Energy Eastern, Inc.	Name Change	DB 0249/0343
North Coast Energy Eastern, Inc.	EXCO-North Coast Energy Eastern, Inc.	Name Change	DB 0277/0068
EXCO-North Coast Energy Eastern, Inc.	EXCO Resources WV, Inc.	Name Change	Exhibit 2
EXCO Resources WV, Inc.	EXCO Production Company WV, LLC	Merger	0285/0083
EXCO Production Company WV, LLC	Antero Resources Appalachian Corporation	Assignment	0285/0084
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Carole Hanlon Lease</u></b>			
Carole Hanlon	Antero Resources Corporation	1/8+	LB0330/0215
<b><u>Charles C. Smith, et al Lease</u></b>			
Charles C. Smith, et al	Duncan Sartain	1/8	LB0068/0463
Duncan Sartain	Walter F. Tucker	Assignment	74/473
Walter F. Tucker	Roscoe B. G. Cowper	Assignment	77/502
Roscoe B. G. Cowper	Lawrence H. Aberegg	Assignment	98/233
Lawrence H. Aberegg	Hugh Spencer	Assignment	98/237
Hugh Spencer	J&J Enterprises, Inc.	Assignment	111/390
J&J Enterprises, Inc.	Eastern American Energy Corporation	Assignment	LB0220/0602
Eastern American Energy Corporation	Energy Corporation of America	Assignment	LB0240/0498
Energy Corporation of America	Antero Resources Appalachian Corporation	Assignment	LB0272/0307
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>William Ashburn Heirs Lease</u></b>			
William Ashburn Heirs	J.C. Smith	1/8	0056/0249
J.C. Smith	John W. Casto	List of Heirs	SF 0008/0071
John W. Casto	Antero Resources Corporation	Assignment	0333/0509

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\*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

WW-6A1  
(5/13)

Operator's Well No. Northrop Unit 2H

**INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE  
Chapter 22, Article 6A, Section 5(a)(5)  
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)**

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

- (1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;
- (2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
<u>William A. Farr Lease</u>				
	William A. Farr	Carolyn E. Farr Trust	1/8	LB0277/0644
	Clarence E. Sigley, Sr. Trustee for the Carolyn E. Farr Trust	Antero Resources Appalachian Corp.	Assignment	LB0281/0310
	Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1

\*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**Acknowledgement of Possible Permitting/Approval  
In Addition to the Office of Oil and Gas**

The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- WV Division of Water and Waste Management
- WV Division of Natural Resources WV Division of Highways
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- County Floodplain Coordinator

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The applicant further acknowledges that any Office of Oil and Gas permit in no way overrides, replaces, or nullifies the need for other permits/approvals that may be necessary and further affirms that all needed permits/approvals should be acquired from the appropriate authority before the affected activity is initiated.

Well Operator: Antero Resources Corporation  
By: Kevin Kilstrom  
Its: Senior Vice President Production

**FORM WW-6A1  
EXHIBIT 1**

**FILED**

**JUN 10 2013**



Penney Barker, Manager  
Corporations Division  
Tel: (304)558-8000  
Fax: (304)558-8381  
Website: [www.wvsos.com](http://www.wvsos.com)  
E-mail: [business@wvsos.com](mailto:business@wvsos.com)

Natalie E. Tennant,  
Secretary of State  
1900 Kanawha Blvd E  
Bldg 1, Suite 157-K  
Charleston, WV 25305

**APPLICATION FOR  
AMENDED CERTIFICATE  
OF AUTHORITY**

Office Hours: Monday – Friday  
8:30 a.m. – 5:00 p.m. ET

**FILE ONE ORIGINAL**  
(Two if you want a filed  
stamped copy returned to you)  
**FEE: \$25.00**

\*\*\*\* In accordance with the provisions of the West Virginia Code, the undersigned corporation hereby \*\*\*\*  
applies for an Amended Certificate of Authority and submits the following statement:

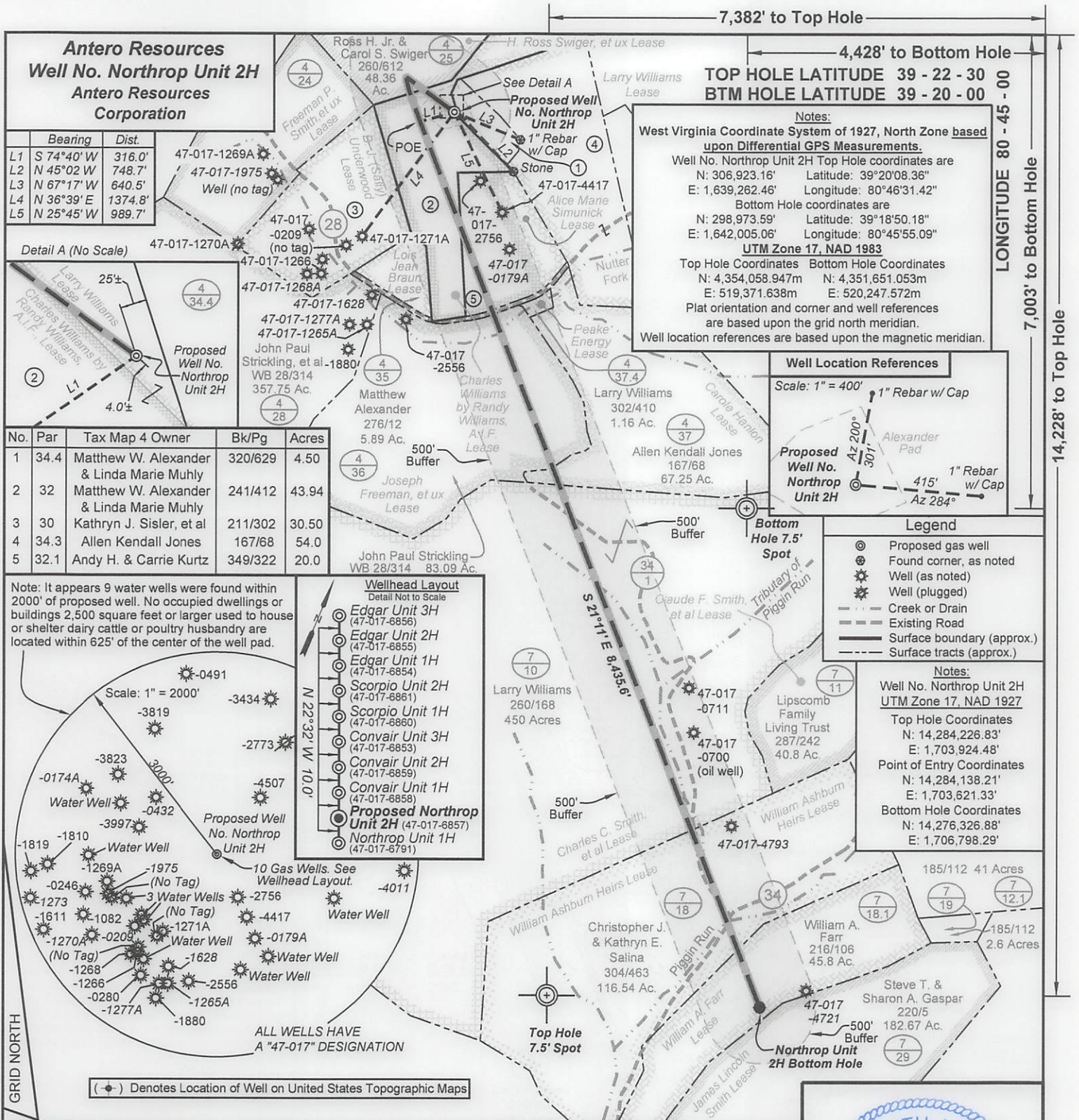
1. Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
2. Date Certificate of Authority was issued in West Virginia: 6/25/2008
3. Corporate name has been changed to: Antero Resources Corporation  
(Attach one Certified Copy of Name Change as filed in home State of incorporation.)
4. Name the corporation elects to use in WV: Antero Resources Corporation  
(due to home state name not being available)
5. Other amendments:  
(attach additional pages if necessary)
6. Name and phone number of contact person. (This is optional, however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)  
Alvyn A. Schopp (303) 357-7310  
Contact Name Phone Number
7. Signature Information (See below *\*Important Legal Notice Regarding Signature\**):  
Print Name of Signer: Alvyn A. Schopp Title/Capacity: Authorized Person  
Signature: *Alvyn A. Schopp* Date: June 10, 2013

*\*Important Legal Notice Regarding Signature\** For West Virginia Code §31D-1-129. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor and, upon conviction thereof, shall be fined not more than one thousand dollars or confined in the county or regional jail not more than one year, or both.

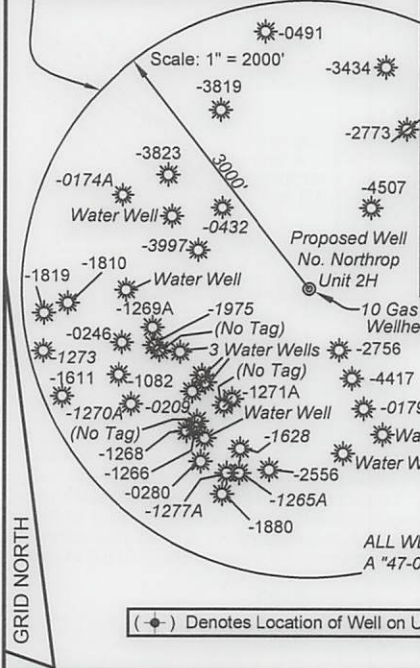
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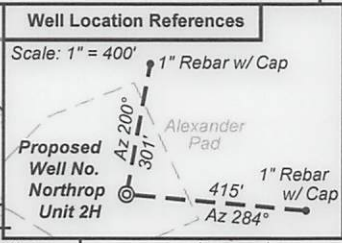
Note: It appears 9 water wells were found within 2000' of proposed well. No occupied dwellings or buildings 2,500 square feet or larger used to house or shelter dairy cattle or poultry husbandry are located within 625' of the center of the well pad.



**Wellhead Layout**  
Detail Not to Scale

- Edgar Unit 3H (47-017-6856)
- Edgar Unit 2H (47-017-6855)
- Edgar Unit 1H (47-017-6854)
- Scorpio Unit 2H (47-017-6861)
- Scorpio Unit 1H (47-017-6860)
- Convaire Unit 3H (47-017-6853)
- Convaire Unit 2H (47-017-6859)
- Convaire Unit 1H (47-017-6858)
- Proposed Northrop Unit 2H (47-017-6857)
- Northrop Unit 1H (47-017-6791)

**Notes:**  
West Virginia Coordinate System of 1927, North Zone based upon Differential GPS Measurements.  
Well No. Northrop Unit 2H Top Hole coordinates are  
N: 306,923.16' Latitude: 39°20'08.36"  
E: 1,639,262.46' Longitude: 80°46'31.42"  
Bottom Hole coordinates are  
N: 298,973.59' Latitude: 39°18'50.18"  
E: 1,642,005.06' Longitude: 80°45'55.09"  
**UTM Zone 17, NAD 1983**  
Top Hole Coordinates Bottom Hole Coordinates  
N: 4,354,058.947m N: 4,351,651.053m  
E: 519,371.638m E: 520,247.572m  
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 corner, as noted
  - ⊛ Well (as noted)
  - ⊙ Well (plugged)
  - ⊙ Creek or Drain
  - ⊙ Existing Road
  - ⊙ Surface boundary (approx.)
  - ⊙ Surface tracts (approx.)

**Notes:**  
Well No. Northrop Unit 2H  
UTM Zone 17, NAD 1927  
Top Hole Coordinates  
N: 14,284,226.83'  
E: 1,703,924.48'  
Point of Entry Coordinates  
N: 14,284,138.21'  
E: 1,703,621.33'  
Bottom Hole Coordinates  
N: 14,276,326.88'  
E: 1,706,798.29'



**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: 48-30-WU-14  
DRAWING NO: Northrop 2H Well Plat 11-16  
SCALE: 1" = 1200'  
MINIMUM DEGREE OF ACCURACY: Submeter  
PROVEN SOURCE OF ELEVATION: WVDOT, Harrisville, WV

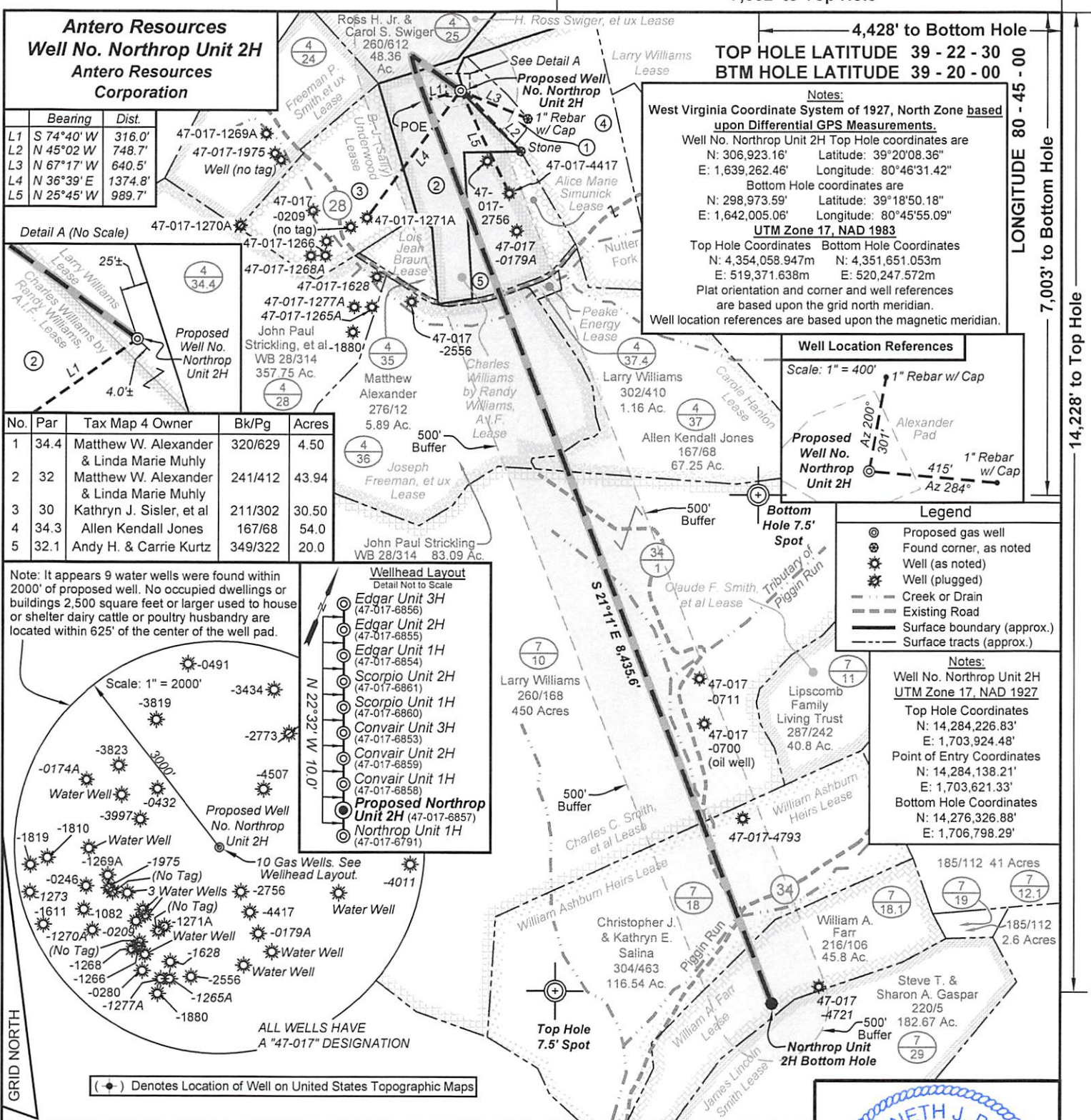
**STATE OF WEST VIRGINIA**  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**OIL AND GAS DIVISION**

DATE: November 15, 2017  
Operator's Well No. Northrop Unit 2H  
API WELL NO  
47 - 017 - 06857  
STATE COUNTY PERMIT

WELL TYPE:  OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  
(IF GAS) PRODUCTION:  STORAGE  DEEP  SHALLOW  
LOCATION: ELEVATION: Existing Grade - 1194' Proposed Grade - 1181' WATERSHED: Headwaters Middle Island Creek QUADRANGLE: West Union  
DISTRICT: West Union COUNTY: Doddridge  
SURFACE OWNER: Matthew W. Alexander & Linda Marie Muhly William A. Farr, Carole Hanlon; H. Ross Swiger, et ux; Charles C. Smith, et al; William Ashburn Heirs; ACREAGE: 43.94 450; 71.5 48.36; 45.8; 120  
ROYALTY OWNER: Larry Williams; Charles Williams by Randy Williams, A.I.F.; Joseph Freeman, et ux LEASE NO: ACREAGE: 428.51; 67; 600  
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: 16,400' 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**

Office of Oil and Gas  
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WV Department of Environmental Protection



FILE NO: 48-30-WU-14  
DRAWING NO: Northrop 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, 2017  
Operator's Well No. Northrop Unit 2H  
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47 - 017 - 06857  
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LOCATION: ELEVATION: Existing Grade - 1194' Proposed Grade - 1181' WATERSHED: Headwaters Middle Island Creek QUADRANGLE: West Union  
DISTRICT: West Union COUNTY: Doddridge

SURFACE OWNER: Matthew W. Alexander & Linda Marie Muhly William A. Farr, Carole Hanlon; H. Ross Swiger, et ux; Charles C. Smith, et al; William Ashburn Heirs; ACREAGE: 43.94 450; 71.5 48.36; 45.8; 120

ROYALTY OWNER: Larry Williams; Charles Williams by Randy Williams, A.I.F.; Joseph Freeman, et ux LEASE NO: ACREAGE: 428.51; 67; 600

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  
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ADDRESS: 1615 Wynkoop Street ADDRESS: 5400 D Big Tyler Road  
Denver, CO 80202 Charleston, WV 25313