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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)

Friday, January 25, 2019  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for HAYHURST 1H  
47-085-10376-00-00

**Lateral Length**

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: HAYHURST 1H  
Farm Name: MICHAEL GAIL UNDERWOOD ET AL  
U.S. WELL NUMBER: 47-085-10376-00-00  
Horizontal 6A New Drill  
Date Modification Issued: January 25,2019

Promoting a healthy environment.



January 9, 2019

Antero Resources  
1615 Wynkoop Street  
Denver, CO 80202  
Office 303.357.7310  
Fax 303.357.7315

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

Ms. Laura Adkins:

Antero Resources Corporation (Antero) would like to submit the following permit modification for an approved well on the existing Black Forest Pad. We are requesting to change the point of entry which will change the lateral length for the Hayhurst Unit 1H (API #47-085-10376).

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the updated POE & Measured Depth
- REVISED Form WW-6A1, which shows the new leases we will be drilling into
- REVISED Mylar Plat, which shows the new Lateral Length & Estimated Measured Depth
- AOR & As-Built Design

If you have any questions please feel free to contact me at (303) 357-7223.

Thank you in advance for your consideration.

Sincerely,

Megan Griffith  
Permitting Agent  
Antero Resources Corporation

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Enclosures

WW-6B  
(04/15)

API NO. 47-085 - 10376  
OPERATOR WELL NO. Hayhurst Unit 1H  
Well Pad Name: Black Forest Pad

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

1) Well Operator: Antero Resources Corporation 494507062 085-Ritchie Clay Ellenboro 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Hayhurst Unit 1H Well Pad Name: Black Forest Pad

3) Farm Name/Surface Owner: Michael Gail Underwood et al Public Road Access: CR 1/4

4) Elevation, current ground: 1083' Elevation, proposed post-construction: \_\_\_\_\_

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 Expected Pressure(s):  
Marcellus Shale: 6700' TVD, Anticipated Thickness- 75 feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6700' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 17900' MD

11) Proposed Horizontal Leg Length: 8913'

12) Approximate Fresh Water Strata Depths: 97', 319'

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

14) Approximate Saltwater Depths: 1507'

15) Approximate Coal Seam Depths: N/A

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

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(a) If Yes, provide Mine Info: Name: \_\_\_\_\_ JAN 10 2019

Depth: \_\_\_\_\_ WV Department of

Seam: \_\_\_\_\_ Environmental Protection

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

WW-6B  
(04/15)

API NO. 47- 085 - 10376  
OPERATOR WELL NO. Hayhurst Unit 1H  
Well Pad Name: Black Forest Pad

18)

**CASING AND TUBING PROGRAM**

<b>TYPE</b>	<u>Size (in)</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling (ft)</u>	<u>INTERVALS: Left in Well (ft)</u>	<u>CEMENT: Fill-up (Cu. Ft.)/CTS</u>
Conductor	20"	New	H-40	94#	80	80	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	369 *see # 19	369 *see # 19	CTS, 513 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500	2500	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	17900	17900	4515 Cu. Ft
Tubing	2-3/8"	New	N-80	4.7#			
Liners							

<b>TYPE</b>	<u>Size (in)</u>	<u>Wellbore Diameter (in)</u>	<u>Wall Thickness (in)</u>	<u>Burst Pressure (psi)</u>	<u>Anticipated Max. Internal Pressure (psi)</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	30"	24"	0.438"	1530	50	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	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"	0.361"	12,630	2500	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

**PACKERS**

Kind:	N/A					RECEIVED Office of Oil and Gas
Sizes:	N/A					JAN 10 2019
Depths Set:	N/A					WV Department of Environmental Protection

WW-6B  
(10/14)

API NO. 47-085 - 10376  
OPERATOR WELL NO. Hayhurst Unit 1H  
Well Pad Name: Black Forest 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): Existing 23.16 acres

22) Area to be disturbed for well pad only, less access road (acres): Existing 11.71 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.

WW-6A1

Operator's Well Number Hayhurst Unit 1H

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>Ronnell L. Underwood et al Lease</u></b>			
Ronnell L. Underwood et al	Rare Earth Energy, Inc.	1/8	0199/0020
Rare Earth Energy, Inc.	Stephen L. Thompson	Assignment	0236/0001
Stephen L. Thompson	Tri-County Oil & Gas, Inc.	Assignment	0236/0237
Tri-County Oil & Gas, Inc.	May Gas, Inc.	Assignment	0239/0229
May Gas, Inc.	Harper Crosby Holdings, LLC	Assignment	0265/0872
Harper Crosby Holdings, LLC	Antero Resources Corporation	Partial Assignment	0285/0298
<b><u>C.B. Morris &amp; S.A. Smith Irrevocable Trust Lease</u></b>			
C.B. Morris & S.A. Smith Irrevocable Trust	Jay-Bee Production Co.	1/8	0240/0203
Jay-Bee Production Co.	Antero Resources Corporation	Assignment	0293/0398
<b><u>Fredrick R. Hayhurst et al Lease</u></b>			
Fredrick R. Hayhurst et al	Clarence W. Mutschelknaus	1/8	0232/0828
Clarence W. Mutschelknaus	Antero Resources Appalachian Corporation	Assignment	0259/0874
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Delno Hayhurst Lease</u></b>			
Delno Hayhurst	Antero Resources Corporation	1/8+	0298/0395
<b><u>Richard E. Blouir et al Lease</u></b>			
Richard E. Blouir et al	Antero Resources Corporation	1/8+	0299/0762
<b><u>Fredrick E. Wanstreet et ux Lease</u></b>			
Fredrick E. Wanstreet et ux	Antero Resources Corporation	1/8+	0299/0211
<b><u>Tom G. Strickler et ux Lease</u></b>			
Tom G. Strickler et ux	Palmer Hill	1/8	0119/0405
Palmer Hill	Clyde Kelly	Assignment	0130/0048
Clyde Kelly	W.F. Zickefoose	Assignment	0201/0659
W.F. Zickefoose	Antero Resources Corporation	Assignment	0294/0971

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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. Hayhurst Unit 1H

**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>West Virginia State Railroad Authority Lease</u>	West Virginia State Railroad Authority	Antero Resources Corporation	1/8+	0300/0337

\*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 VP - Production

FILED

JUN 10 2013

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



Penney Barker, Manager  
IN THE OFFICE OF  
SECRETARY OF STATE  
Corporations Division  
Tel: (304)558-8000  
Fax: (304)558-8381

Website: [www.wvscd.com](http://www.wvscd.com)  
E-mail: [business@wvscd.com](mailto:business@wvscd.com)

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

FILE ONE ORIGINAL  
(Two if you want a hand  
stamped copy returned to you)  
FEE: \$35.00

APPLICATION FOR  
AMENDED CERTIFICATE  
OF AUTHORITY

\*\*\* 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:

- Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachia Corporation
- Date Certificate of Authority was issued in West Virginia: 6/26/2008
- Corporate name has been changed to: Antero Resources Corporation  
(Attach one Certified Copy of Name Change as filed in home State of incorporation.)
- Name the corporation elects to use in WV: Antero Resources Corporation  
(due to home state name not being available)
- Other amendments:   
(attach additional pages if necessary)
- 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.)  
Allyn A. Schopp (304) 367-7310  
Contact Name Phone Number
- Signature information (See below *Important Local Notice Regarding Signatures*):  
Print Name of Signer: Allyn A. Schopp Title/Capacity: Authorized Person  
Signature: *Allyn A. Schopp* Date: June 10, 2013

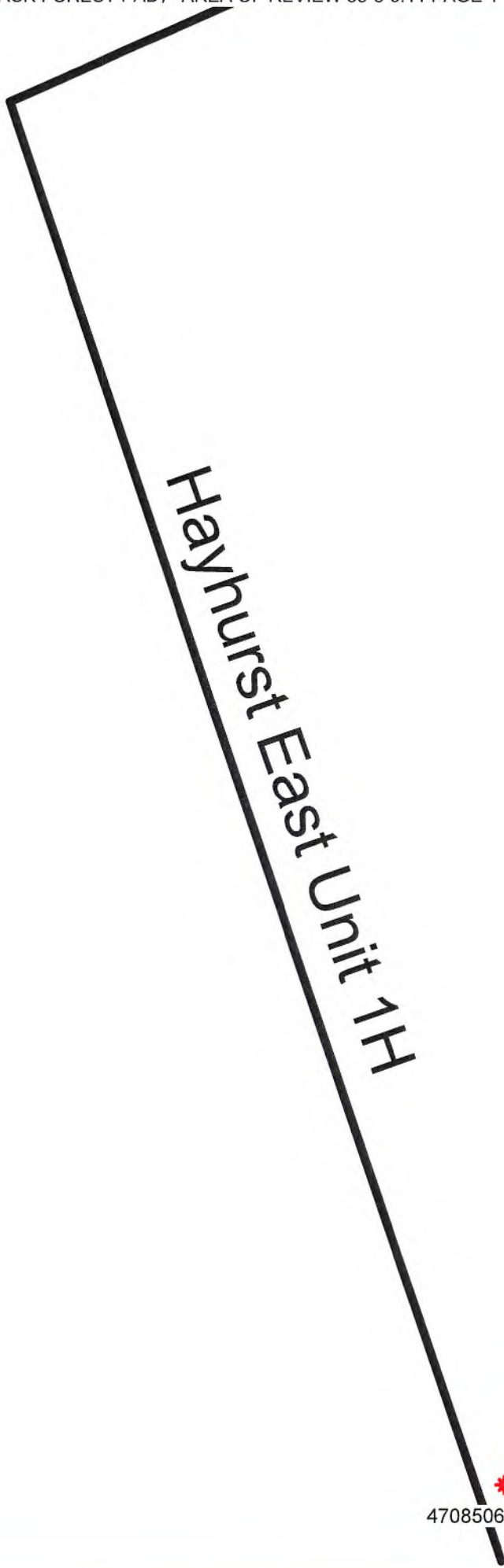
*Important Local Notice Regarding Signatures* For West Virginia Code §21D-1-12b. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor 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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**Antero Resources Corporation**

Hayhurst East Unit 1H - AOR



**WELL SYMBOLS**  
Gas Well

September 10, 2018

47085063070000

UWI (APINum)	Well Name	Well Number	Operator	Historical Operator	TD	Perforated Interval (shallowest, deepest)	Perforated Formation(s)	Producible Formation(s) not perf'd
47085063070000	BLOUIR R E & M L	3	MUTSCHELKNAUS C W	JENKINS ENERGY	5,815	4411-4804	Big Injun, Riley, Benson, Rhinestreet	Weir, Alexander

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